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DEVONIAN AND MISSISSIPPIAN CONULARIIDS OF NORTH AMERICA. PART B. *PARACONULARIA, RETICULACONULARIA,* NEW GENUS, AND ORGANISMS REJECTED FROM CONULARIIDA

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ABSTRACT

Descriptions of the species assigned to *Paraconularia* Sinclair, 1940 and *Reticulaconularia* Babcock and Feldmann, new genus, as well as organisms rejected from the Conulariida, are treated in Part B of this two-part work on the Devonian and Mississippian conulariids of North America. Fifteen species of *Paraconularia* are considered valid, of which five are new. The new taxa are *P. alpenensis, P. chagrinensis, P. oklahomaensis, P. wellsvillia,* and *P. yochelsoni. Adesmoconularia* Driscoll, 1963 is considered a junior synonym of *Paraconularia.* Two species are referable to *Reticulaconularia* Babcock and Feldmann, new genus; *Conularia penouili* is selected as the type species.

INTRODUCTION

This paper is the second, and final, part of "Devonian and Mississippian Conulariids of North America." This work contains descrip-

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tions of species referable to the genera *Paraconularia* and *Reticulaconularia* n. gen., as well as specimens described in the literature as conulariids but which are here rejected from the phylum. Locality descriptions and measurements of selected specimens are included as appendices A and B, respectively, herein. Figures are numbered consecutively in both Parts A and B in order to avoid cross-reference confusion.

Genus *PARACONULARIA* Sinclair, 1940

Type species.—*Conularia inequicostata* Koninck, 1883, designated by Sinclair (1940); Carboniferous of Belgium. Holotype: Musée Royal d'Histoire Naturelle de Belgique, Brussels, Belgium. North American reference species, *fide* Sinclair (1940): *Conularia blairi* Miller and Gurley, 1893 (Mississippian). Lectotype of *C. blairi*: UCGM 3985.

Diagnosis.—Conulariids with rods that are generally widely spaced, 4–35 rods/cm. More than 60% of rods alternate at midline; fewer than 40% abut. Apical angles small, 9–28°. Nodes, adapertural spines and adapical spines may or may not be present; if present, they are usually widely spaced, 2–6/mm.

PARACONULARIA ALPENENSIS
Babcock and Feldmann, new species
Figs. 17.1–17.3

Description.—Description based only upon holotype. Exoskeleton 3.6 cm in length. Major apical angle 21°; minor apical angle 16°. Rod articulation inflected circular curve style; rods are slightly recurved near midline in apertural region. Rods abut or alternate at midline; alternation pattern either right superior or left superior on major face, usually left superior on minor face; rod angle 9–10°. 14 rods/cm. Nodes not observed; spines absent. Apical wall not observed.

Occurrence.—Middle Devonian of Michigan; locality 92.

Type.—Holotype, GSC 85060.

Remarks.—This taxon is similar to *P. chesterensis* (Worthen), *P. missouriensis* (Swallow) and *P. recurvatus* Babcock and Feldmann, n. sp. in the possession of rods that are recurved near the midline. *Paraconularia alpenensis,* however, exhibits rods that are not recurved in the apical region, at least not in the holotype. None of the other three taxa possess this characteristic.

It is not known whether *P. alpenensis* possessed nodes on the rods. The holotype, and only known specimen, is weathered and lacks the external surfaces of all the rods which are present. No spines are present. The uniqueness of the rod articulation patterns are sufficient to distinguish this taxon from all other described taxa.

Material examined.—1 specimen, GSC 85060.

Etymology of trivial name.—Named for the Alpena Limestone, in which the holotype was found.

PARACONULARIA ALTERNISTRIATA (Shimer, 1926)
Figs. 17.5–17.6

Conularia alternistriata Shimer, 1926, p. 84, Pl. 4, figs. 11a–b.
Paraconularia alternistriata (Shimer). Sinclair, 1948, p. 190.

Description.—Description based only upon holotype. Length 1.9 cm. Major apical angle 11°; minor apical angle 10°. Rod articulation inflected gothic arch style; rods are almost imperceptibly inflected near the corner angles. Rods always alternate at midline; alternation pattern usually right superior on major face and usually left superior on minor face; rod angle 9–10°. 28 rods/cm (extrapolated). Nodes and spines absent. Apical wall not observed.

Occurrence.—Mississippian of Alberta; locality 4.

Type.—Holotype, GSC 5111.

Remarks.—*Paraconularia alternistriata* (Shimer) is similar in morphology to specimens of *P. yochelsoni* Babcock and Feldmann, n. sp. Both are of similar size, less than 3.5 cm in maximum length and both exhibit similar forms of rod articulation style. The rod articulation present on the holotype of *P. alternistriata* is here judged to be a form of inflected gothic arch style. The rods in this specimen are inflected so little, though, that the articulation could easily be confused for a gothic arch style articulation pattern. This may simply be a function of the small size of the holotype; a sample close to the aperture of a larger specimen may yield a rod articulation pattern more distinctly of an inflected gothic arch style. *Paraconularia yochelsoni* possesses rods which are clearly articulated in an inflected gothic arch style close to the apex and trending towards an inflected circular curve style near the aperture. *Paraconularia alternistriata* is further distinguished from *P. yochelsoni* in having a smaller apical angle, 10–11°, as compared to 15–20° in *P. yochelsoni* and, finally, in having greater rod spacing, 28 rods/cm as compared to 13–18 rods/cm.

The holotype, and only known specimen, of *P. alternistriata* exhibits longitudinal folds in the integument between adjacent rods suggesting that spines may have been present in this taxon. The folds are best developed near the corner angles. Their occurrence seems to be erratic and the spacing between adjacent folds is inconsistent. In all likelihood, these folds do not represent integument folded over spines but simply folds resulting from a contraction of the integument about the rods and, perhaps, some shearing of the exoskeleton due to compression. This phenomenon is relatively common among specimens of *Paraconularia,* having also been observed in *P. subulata* (Fig. 3.2) and *P. missouriensis* (Fig. 25.3).

Material examined.—1 specimen, GSC 5111.


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PARACONULARIA BLAIRI (Miller and Gurley, 1893)
Figs. 18.1–18.5, 22.1–22.3

Conularia blairi Miller and Gurley, 1893, p. 73–74, pl. 7, figs. 14–15; Miller, 1897, p. 765; Weller, 1898, p. 189; Chappars, 1936, p. 16; Branson, 1938, p. 110, Pl. 14, figs. 7–8; Branson, 1944, p. 216.
Conularia sedaliensis Miller and Gurley, 1896, p. 28, Pl. 3, figs. 4–5; Miller, 1897, p. 765; Weller, 1898, p. 191; Chappars, 1936, p. 16.
Conularia (*Conularia*) *sedaliensis* Miller and Gurley. Bouček, 1939, p. A 121.
Conularia (*Paraconularia*) *blairi* (Miller and Gurley). Sinclair, 1940, p. 74.
Paraconularia blairi (Miller and Gurley). Sinclair, 1948, p. 197; Moore and Harrington, 1956, p. F65, fig. 50.2.
Paraconularia sedaliensis Miller and Gurley. Sinclair, 1948, p. 201.
Paraconularia indiana Sinclair, [1948], p. 195, Pl. 18, figs. 1–2.
Paraconularia cf. *newberryi* (Winchell). *Sensu* Sinclair, 1948, Pl. 13, figs. 1–3.
Paraconularia missouriensis (Swallow). *Sensu* Babcock and Feldmann, 1984, p. 16–17.

Description.—Exoskeleton up to 20 cm in length. Major apical angle 11–23°; minor apical angle 10–20°. Rod articulation inflected gothic arch style in apical region and inflected circular curve with a slight adapertural inflection at the midline elsewhere. Rods almost always alternate at midline; alternation pattern usually right superior on major and minor faces; rod angle 8–19°. 6–13 rods/cm. 2–3 nodes/mm; 2–3 adapertural spines/mm; adapical spines absent. Apical wall not observed.

Types.—Three syntypes of *C. blairi,* UCGM 3984–3986, of which UCGM 3986 (Fig. 18.5) is here designated the lectotype; UCGM 3984–3985 are here designated the lectotype; UCGM 3984–3985 are here considered paralectotypes. Four syntypes of *C. sedaliensis,* preserved in five pieces, UCGM 1393, 1399; specimen intended by Sinclair (1948) to be holotype of *P. indiana,* AMNH 25056.

Occurrences.—Lower Mississippian of Illinois, Indiana, Iowa, and Missouri; localities 11, 32, 35, 61, 94–98, 101, and 105. Laudon and Bowsher (1941) reported this taxon in the Mississippian of New Mexico, but their material was not available for study.

Remarks.—*Paraconularia blairi* (Miller and Gurley) is unique among species of *Paraconularia* in having rods that exhibit inflected circular

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Fig. 17.—17.1; *Paraconularia alpenensis* Babcock and Feldmann, n. sp., GSC 85060, holotype, minor face of specimen preserved in micrite; locality 92. 17.2; GSC 85060, same specimen as in Fig. 17.1, corner view. 17.3; GSC 85060, same specimen as in Fig. 17.1, major face. 17.4; USNM 173926, *Hyolithes* sp., crushed specimen of a hyolithid; locality 240. 17.5–17.6; *P. alternistriata* Shimer. 17.5; GSC 5111, holotype, major face; locality 4. 17.6; GSC 5111, same specimen as in Fig. 17.5, minor face. 17.7–17.8; *P. chesterensis* (Swallow). 17.7; GSC 85061, a collapsed specimen preserved in siltstone; locality 27. 17.8; GSC 85061, enlargement of same specimen as in Fig. 17.7. Note inconspicuous spines on the rods. Bar scales in Figs. 17.1–17.4 and 17.7–17.8 represent 1 cm; bar scales in Figs. 17.5 and 17.6 represent 5 mm.

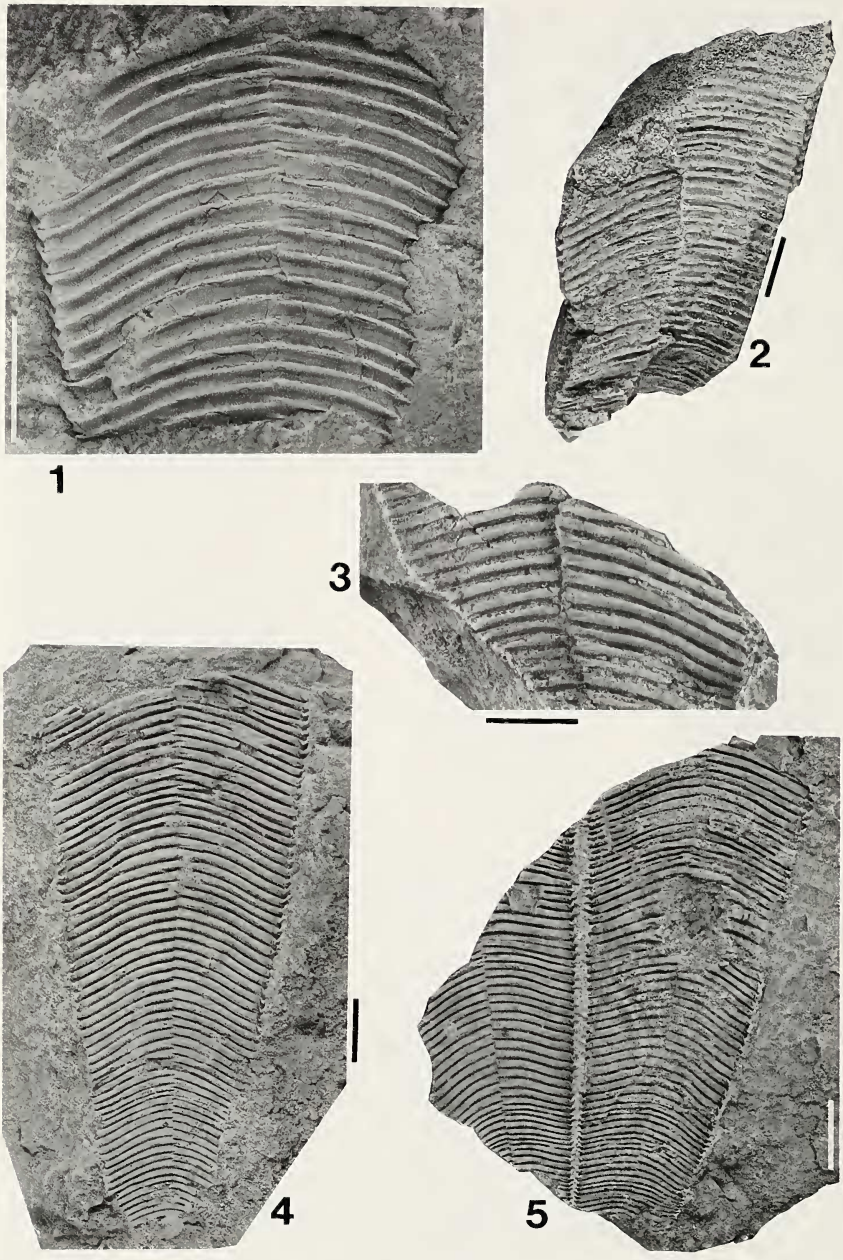

Fig. 18.—*Paraconularia blairi* (Miller and Gurley). 18.1; UMC 4270, detailed view of well preserved ?major face; locality 96. 18.2; UCGM 3985, syntype of *Conularia se-*

curve style rod articulation and which are slightly inflected at the midline. However, distinction between this species and *P. subulata* is often difficult, especially in small specimens that preserve only inflected gothic arch style rod articulation. Distinction between the two species can be made on these criteria: 1, *P. blairi* possesses distinct nodes on the rods, *P. subulata* usually does not; 2, *P. blairi* has a slight adapertural inflection of the rods near the midline except in the apical region, *P. subulata* does not; and 3, *P. blairi* possesses 6–13 rods/cm whereas *P. subulata* has 20–35 rods/cm.

Two species are here considered synonymous with *P. blairi*: *P. sedaliensis* (Miller and Gurley) and *P. indiana* Sinclair, MS. The type specimens of both are well enough preserved to compare all qualitative and quantitative features of taxonomic interest. Values obtained by measuring these specimens are given in Appendix B. In all respects, *P. sedaliensis* and *P. indiana* are indistinguishable from the lectotype and paralectotypes of *P. blairi*.

Material examined.—34 specimens; housed in the AMNH, FMNH, UCGM, UMC, and the USNM.

PARACONULARIA BYBLIS (White, 1862)
Figs. 3.7, 19.1–19.6, 23.2, 31.4

Conularia byblis White, 1862, p. 22; Miller, 1877, p. 141; Bigsby, 1878, p. 78; Herrick, 1888*a*, p. 95; Miller, 1889, p. 390; Weller, 1898, p. 189; Weller, 1900*a*, p. 118–119, Pl. 7, fig. 7; Weller, 1900*b*, p. 73; Grabau and Shimer, 1910, p. 14.
Conularia byblis White. Winchell, 1870, p. 257.
Conularia biblis (*sic*) White. Bigsby, 1878, p. 316.
Paraconularia byblis (White). Sinclair, 1948, p. 200–201; Babcock and Feldmann, 1986, figs. 1E, 2B.
Adesmoconularia byblis (White). Driscoll, 1963, p. 40–41, Pl. 3, figs. 1–7; Tasch, 1973, fig. 5.14 Ga–b; Tasch, 1980, fig. 5.14 Ga–b.
Conularia? sp. Driscoll, 1963, p. 41, Pl. 3, fig. 8.

Description.—Exoskeleton up to 7 cm in length. Major apical angle 18–26°; minor apical angle 10–19°. Rod articulation inflected gothic arch style in apical region and inflected circular curve style elsewhere; rods are strongly inflected adaperturally at midline; rod angle 12–18°. Rods generally abut at midline; 12–29 rods/cm. 1–2 nodes/mm; spines seem to be absent. Apical wall may be present.

Occurrences.—Lower Mississippian of Indiana, Iowa, Kentucky and Ohio; localities 29, 36, 39, 43, 50, 60, 62, 66, 71–72, 76, 77, 78, 81,

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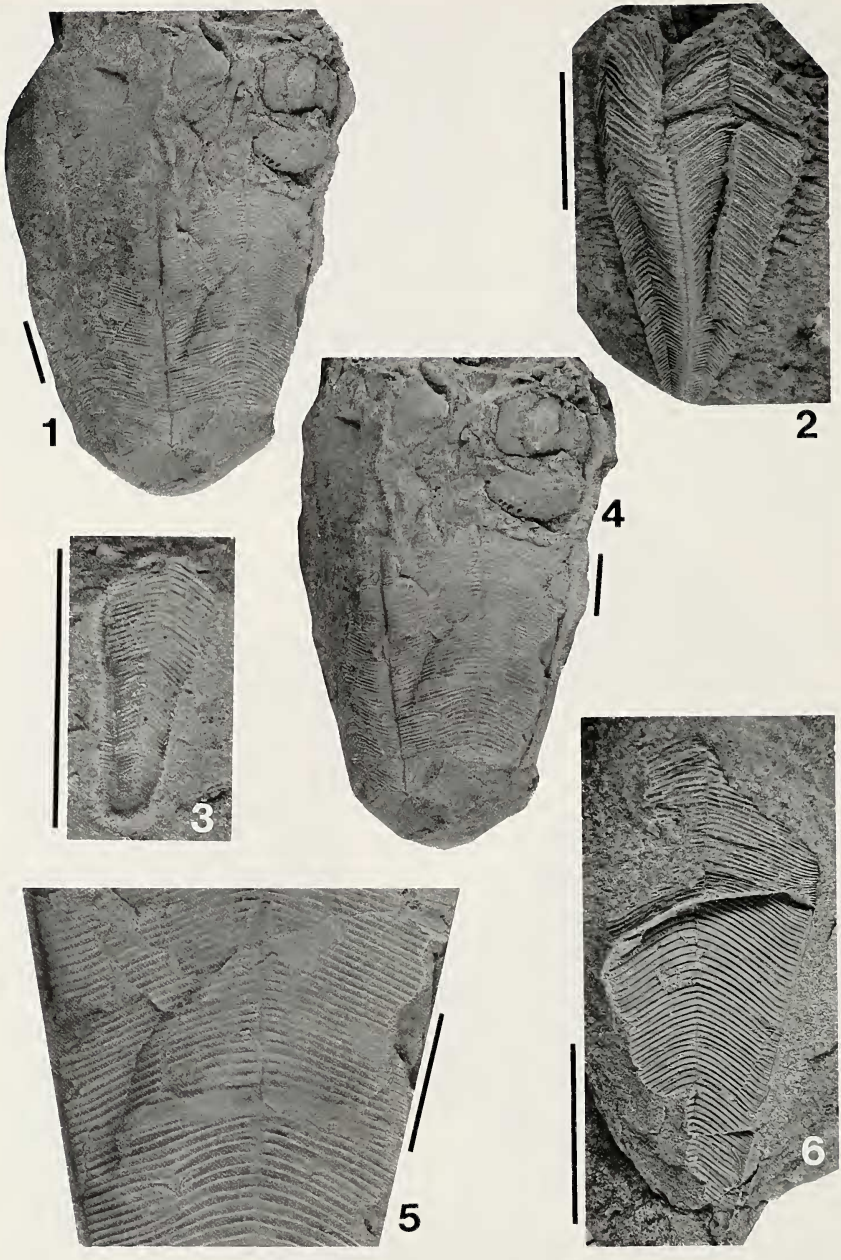
daliensis Miller and Gurley; locality 98. 18.3; UCGM 3985, counterpart of specimen in Fig. 18.2. 18.4; UCGM 3984, paralectotype, ?minor face; locality 98. 18.5; UCGM 3986, lectotype, a flattened specimen preserved in micrite; locality 98. Bar scales represent 1 cm.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185, 195, 210, and 223–224. A specimen referred with question to this species, UMMP 26735, is from Tennessee; locality 250.

Types.—Holotype, UMMP 2167.

Remarks.—*Paraconularia byblis* (White) is distinguished from all other species of *Paraconularia* by the combination of closely spaced rods, 12–29/cm, the lack of spines and by rod articulation involving an inflected gothic arch style in the apical region and an inflected circular curve style elsewhere. There does not seem to be a species present in the Devonian or Mississippian rocks of North America with which this taxon could be easily confused if well preserved specimens were available for study.

Driscoll (1963), designated *C. byblis* White as the type species of a new genus, *Adesmoconularia. Adesmoconularia,* by Driscoll's definition, is distinguished from *Calloconularia* Sinclair by a larger size and a lack of "swelling" of the interridge areas near the corner angles in *Adesmoconularia. Adesmoconularia* was deemed by Driscoll unlike *Paraconularia* Sinclair in the lack of nodes and by the presence of an apical wall in *Adesmoconularia.* To date, no other species have been referred to the genus *Adesmoconularia.*

Examination of the holotype of *Calloconularia strimplei* Sinclair (FMNH PE 142), the type species of the genus *Calloconularia,* reveals that there is no expansion of the interridge areas near the corner angles. Examination of the holotype of *Conularia byblis* White, type species of the genus *Adesmoconularia* Driscoll, shows that nodes are present on the rods, but they are very small and inconspicuous. The holotype appears to have been considerably weathered, rendering the nodes inconspicuous in most places on the specimen. Apical walls are present, but rare, in specimens of *Paraconularia.* According to Driscoll's diagnosis, then, size is the only criterion which distinguishes *Adesmoconularia* from *Calloconularia*; there is no distinction between *Adesmoconularia* and *Paraconularia.* Therefore, *Adesmoconularia* Driscoll, 1963 is here considered a junior synonym of *Paraconularia* Sinclair, 1940.

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Fig. 19.—*Paraconularia byblis* (White). 19.1; UMMP 2167, holotype, a weathered specimen preserved in micritic limestone, corner view; locality 62. 19.2; CMNH 4492, small specimen, preserved in shale and compressed along the faces and at the aperture; locality 219. 19.3; CMNH 2295, external mold preserving apical region; locality 195. 19.4; UMMP 2167, same specimen as in Fig. 19.1, minor face. 19.5; UMMP 2167, same specimen as in Fig. 19.1, detail of minor face. 19.6; CMNH 4691, ?major face of a specimen preserved in shale; locality 185. Bar scales represent 1 cm.

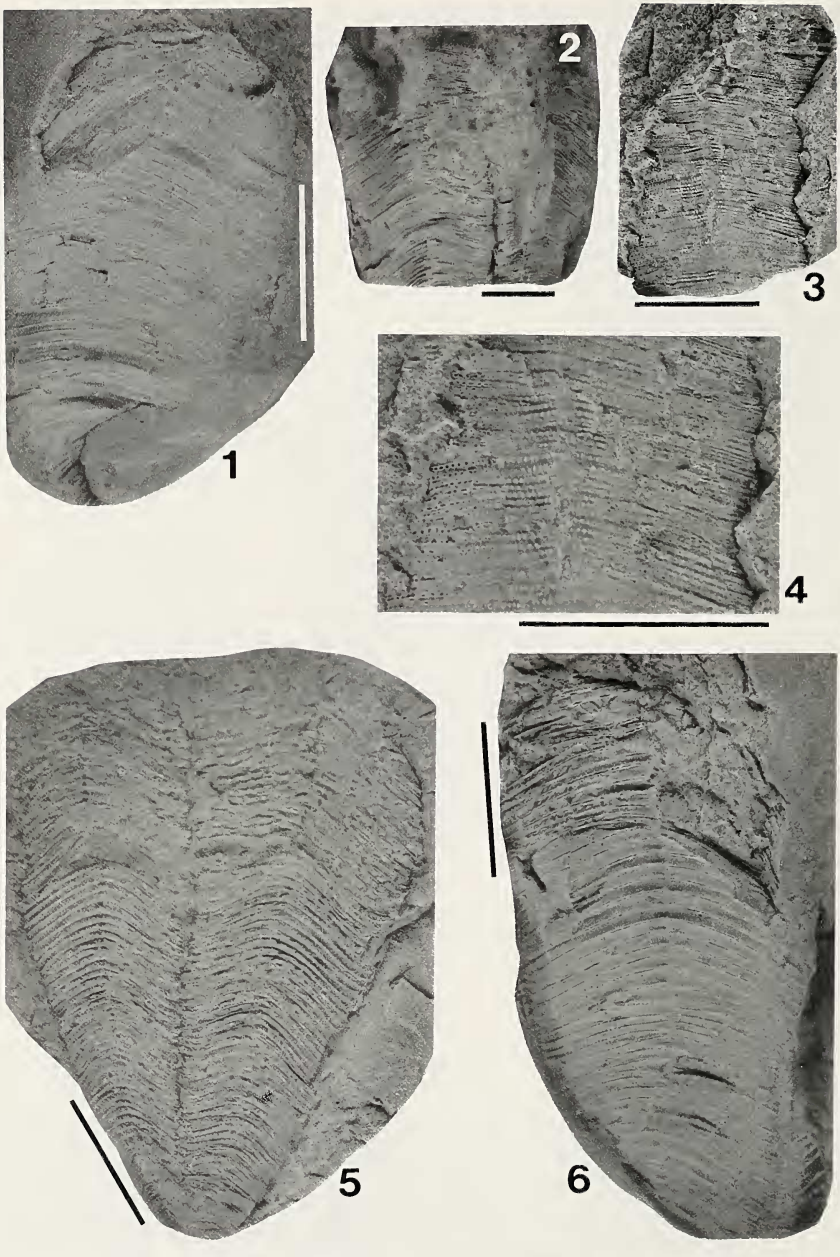

Fig. 20.—*Paraconularia chagrinensis* Babcock and Feldmann, n. sp. 20.1; CMNH 6717, paratype, preserved in a dark gray phosphatic concretion. Note apparent healed wound;

Material examined.—53 specimens; housed in the CM, CMNH, GSC, FMNH, UMMP, and the USNM.

PARACONULARIA CHAGRINENSIS

Babcock and Feldmann, new species

Figs. 20.1–20.6, 21.1, 21.2

Description.—Exoskeleton up to 9 cm in length. Major apical angle about 28°; minor apical angle 20–21°. Rod articulation exclusively of inflected gothic arch style. Rods usually alternate at midline; rods, if they alternate, usually alternate left superior on both major and minor faces; rod angle 9–12°. 16–20 rods/cm. 3–4 nodes/mm; nodes appear to be subtle in apical region and prominent in apertural region; 3–4 adapertural spines/mm; 3–4 adapical spines/mm. No apical wall observed.

Occurrences.—Upper Devonian of Ohio; localities 178–184.

Types.—Holotype, CMNH 6633; 12 paratypes, CMNH 1247, 1272, 1427, 1622, 1674, 1788, 1818, 4030, 4292, 6717, 6807–6808.

Remarks.—Among species of *Paraconularia,* only *P. chagrinensis* Babcock and Feldmann, n. sp. possesses the combination of wide apical angles, 20–28°, adapertural and adapical spines, as well as rod articulation which is exclusively of inflected gothic arch style. More striking, however, is the pattern of nodes on the rods. *Paraconularia chagrinensis* is the only conulariid observed which appears to have nodes which increase in size aperturally. Nodes are inconspicuous in the apical region, but are prominent in the apertural region. The increase in size of the nodes is not well shown in the holotype owing to the poor preservation of the apertural region of this individual. The pattern is well documented, however, in CMNH 6717 (Fig. 20.6).

When fragments of exoskeleton from the apertural region are found alone, as is the case with the specimen illustrated in Figs. 20.3–20.4, they are easily mistaken for species of *Conularia* such as *C. subcarbonaria* or *C. multicostata.* This dilemma can be resolved only when more complete material is found. Most conulariids from the small, presumably phosphatic, nodules found in the Upper Devonian Chagrin Shale of northeastern Ohio are preserved as fragmentary specimens, which renders generic identification difficult. To date, only *P. chagrinensis* has been identified from this unit.

One paratype, CMNH 6717, is noteworthy not only for demonstrating the unique pattern of the nodes, but also for exhibiting an apparent

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locality 179. 20.2; CMNH 1622, paratype; locality 184. 20.3; CMNH 1818, paratype; locality 181. 20.4; CMNH 1818, same specimen as in Fig. 20.3, detail showing nodes and spines. 20.5; CMNH 6633, holotype; locality 180. 20.6; CMNH 6717, same specimen as in Fig. 20.1, ?minor face. Note increase in size of nodes adaperturally. Bar scales represent 1 cm.

healed injury on one face (Fig. 20.1). On this specimen, rods in the apertural region have been truncated and their broken ends rounded slightly. Several rods have filled much of the region from where exoskeleton has been removed. These rods are oriented at a high angle to the rods which comprise the remainder of the exoskeleton and are complete with a midline distinct from the original midline on this face. A small gap is left between the most adapical portion of the injury and the most adapical rods which have filled the void. This region is filled with integument that lacks embedded rods.

Material examined.—13 specimens; housed in the CMNH.

Etymology of trivial name.—Named for the Chagrin Shale, currently the only known occurrence of this taxon.

PARACONULARIA CHESTERENSIS (Worthen, 1883)
Figs 17.7–17.8, 22.4–22.7, 23.1–23.4, 23.7, 24.1, 24.3, 32.5

Conularia chesterensis Worthen, 1883, p. 325; Miller, 1889, p. 390, Worthen, 1890, p. 134, Pl. 11, fig. 9a–b; Miller, 1897, p. 765; Weller, 1898, p. 189; Kent, 1982, p. 27.
Paraconularia chesterensis Worthen. Sinclair, 1948, p. 201–202; Babcock and Feldmann, 1986, fig. 4C.
Paraconularia newberryi (Winchell). *Sensu* Driscoll, 1963, Pl. 2, figs. 6–9.
Paraconularia crawfordsvillensis (Owen). *Sensu* Lane, 1973, p. 93–95, Pl. 8, fig. 1, Pl. 9, figs. 1–2.

Description.—Exoskeleton up to 20 cm in length. Major apical angle 14–21°; minor apical angle 10–18°. Rod articulation exclusively of inflected circular curve style, recurved near the midline. Rods alternate or abut at midline; rods, if they alternate, are not preferentially right superior or left superior on either the major or minor face; rod angle 8–12°. 8–20 rods/cm. 4–5 nodes/mm; adapertural spines appear to be absent in apical region, but small spines are sometimes present, 4–5/mm, in apertural region; adapical spines absent. Apical wall not observed.

Occurrences.—Upper Mississippian of Alabama, Kentucky, Illinois, Indiana, Iowa, Missouri, Nevada, Tennessee; localities 1, 10–12, 16–21, 33, 35–36, 38–41, 47, 49–59, 70, 84–89, 104, 110, and 251. Specimens referred questionably to this species have also been found in British Columbia and Utah; localities 7 and 352.

Types.—Holotype, ISGS 2489.

Remarks.—*Paraconularia chesterensis* (Worthen) is similar to *P. alpenensis* Babcock and Feldmann, n. sp., *P. missouriensis* (Swallow) and *P. recurvatus* Babcock and Feldmann, n. sp. in having rods that are recurved near the midline. Of these, *P. alpenensis* does not exhibit rods that are recurved in the apical region, and both *P. missouriensis* and *P. recurvatus* exhibit rods that are strongly recurved. The rods of *P. chesterensis* tend to be slightly recurved. A rod pair in this taxon often approximates the outline of a truncated pyramid (Figs. 22.4, 22.7).

In some cases, values for apical angles, rods/cm and rod angles may

be similar for specimens of *P. chesterensis* and *P. missouriensis*. If rod articulation is also similar, distinction between the two may be made on the basis of the spacing between nodes. *Paraconularia chesterensis* possesses 4–5 nodes/mm and *P. missouriensis* possesses only 2–3 nodes/mm.

Specimens referable to *P. chesterensis* which have been observed with well-preserved spines are few in number. Moreover, it seems that spines are only produced in the apertural regions of those individuals that have them. When present, the spines are usually inconspicuous and seem to be directed only in the apertural direction (for example, Fig. 17.8). Many specimens referable to *P. chesterensis* (for example, Fig. 23.2), however, seem to have small ridges developed in the integument between ridges. These ridges resemble interridge crests. Such structures may indicate that adapertural, and perhaps even adapical, spines are produced in areas other than the apertural region in this taxon. No specimens exhibiting this have been observed to date. Thus, the observations that only adapertural spines are present in *P. chesterensis,* and when present, that they occur only in the apertural region, may be erroneous and owing to a lack of evidence to the contrary.

Material examined.—355 specimens; housed in the FMNH, GSC, ISGS, IUPC, and the USNM.

PARACONULARIA MISSOURIENSIS (Swallow, 1860)
Figs. 21.3, 25.1, 25.2–25.5, 26.1–26.2, 32.1

Conularia missouriensis Swallow, 1860, p. 657; Miller, 1877, p. 141; Bigsby, 1878, p. 316; Miller, 1889, p. 390; Keyes, 1894, Pl. 35, fig. 1a–b; Miller, 1897, p. 765; Weller, 1898, p. 190; Grabau and Shimer, 1910, p. 14; Branson, 1944, p. 246.

Conularia missouriensis Swallow?. Meek and Worthen, 1873, p. 541–542, Pl. 22, fig. 5; White, 1880, p. 513, Pl. 6, fig. 4; Walcott, 1884, p. 264, Pl. 23, fig. 4.

Paraconularia missouriensis (Swallow). Sinclair, 1948, p. 198–199.

Conularia gratiosa Miller and Gurley, 1893, p. 74, Pl. 8, fig. 1; Miller, 1897, p. 765; Weller, 1898, p. 190.

Conularia greenei Miller and Gurley, 1896, p. 27–28, Pl. 3, fig. 3; Miller, 1897, p. 765; Weller, 1898, p. 190, Cumings, 1906, p. 1367, Pl. 24, fig. 14.

Paraconularia greenei (Miller and Gurley). Sinclair, 1948, p. 194.

Paraconularia gratiosa (Miller and Gurley). Sinclair, 1948, p. 198.

Paraconularia sciotovillensis Driscoll, 1963, p. 37–40, Pl. 1, figs. 9–12; Tasch, 1973, fig. 5.16, Table 5.2; Tasch, 1980, fig. 5.16, Table 5.2.

Ctenoconularia? greenei (Miller and Gurley). Moore and Harrington, 1956, p. F65, fig. 51.4.

Conularia sp. Leary, 1985, Pl. 3, fig. 4.

Paraconularia cf. *P. missouriensis* (Swallow). Babcock, 1985*a*, p. 66–70, fig. 1A–B.

Description.—Exoskeleton up to 22 cm in length. Major apical angle 14–22°; minor apical angle 10–18°. Rod articulation inflected circular curve style, strongly recurved near the midline. Rods usually alternate at midline; if rods alternate, pattern is usually left superior; rod angle 6–17°. 4–10 rods/cm. 2–3 nodes/mm; 2–3 adapertural spines/mm; adapical spines absent. Apical wall not observed.

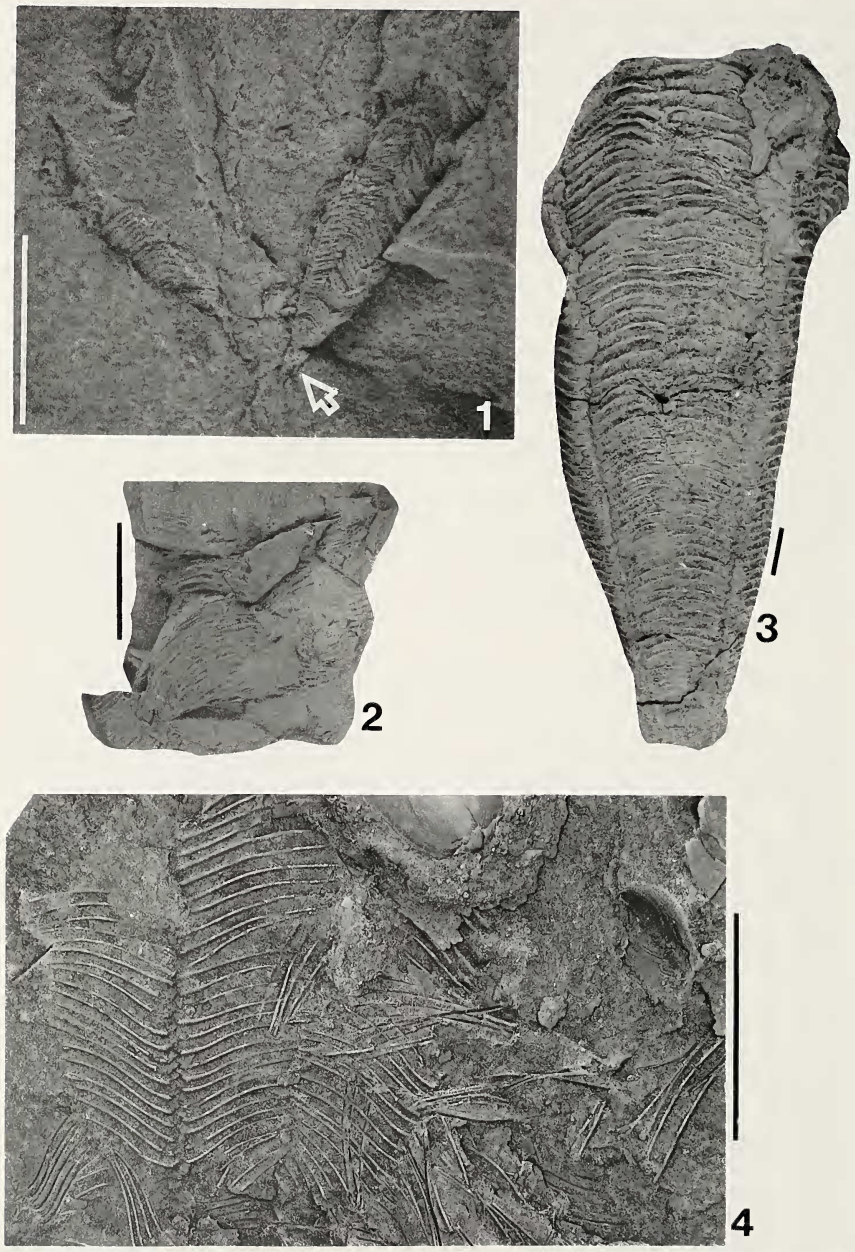

Fig. 21.—21.1; *Paraconularia chagrinensis* Babcock and Feldmann, n. sp., CMNH 1788, two small paratype specimens, presumably attached to the same object (obscured) and

Occurrences.—Lower Mississippian of Alberta, Illinois, Indiana, Iowa, Kentucky, Missouri, and Ohio; localities 2, 5, 14–15, 31, 39, 69, 83, 94, 100, 103, 223 and 226–227. A specimen referred with question to this species has been found in Alberta; locality 5.

Types.—Plaster cast of presumed holotype, FMNH UC 6639. Holotype of *C. gratiosa,* FMNH UC 6627, plastoholotype, USNM 67893; holotype of *C. greenei,* FMNH UC 6628, plastoholotype USNM 67880; holotype of *P. sciotovillensis,* UMMP 26740.

Remarks.—Considerable confusion has existed over the definition of *P. missouriensis* (Swallow). This confusion of nomenclature is related to at least two problems: 1, an ambiguous original definition of the species, a definition which may have incorporated characters now identified as belonging to at least two species; and 2, a loss of Swallow's original specimens. Swallow's type material was found in the "Carboniferous Limestone" of Cooper County, Missouri. This locality has yielded at least two conulariid species; herein, they are identified as *P. missouriensis* and *P. blairi.* It is possible, from Swallow's description (Swallow, 1860, p. 657), that specimens belonging to both forms were used in the formulation of the original definition of *P. missouriensis.*

Some early authors, most notably Meek and Worthen (1873) and Keyes (1894), used Swallow's indication that the faces of *P. missouriensis* were "marked by flexuous, high, sharp plications" as the primary determinative characteristic of the species. This concept of the species is followed herein. A plaster cast of a specimen, marked "holotype?" of *P. missouriensis* (FMNH UC 6639) is presumed to represent a cast of the holotype of this species.

Paraconularia missouriensis is similar to *P. chesterensis* (Worthen) in having an inflected circular curve style of rod articulation, with the rods being reflexed near the midline. The degree of reflexure, however, is greater in *P. missouriensis. Paraconularia missouriensis* can also be distinguished from *P. chesterensis* by having a greater number of nodes/mm on the rods, 4–5 nodes/mm as compared to 2–3 nodes/mm.

Other species of *Paraconularia* which have recurved rods include *P. alpenensis* Babcock and Feldmann, new species and *P. recurvatus* Bab-

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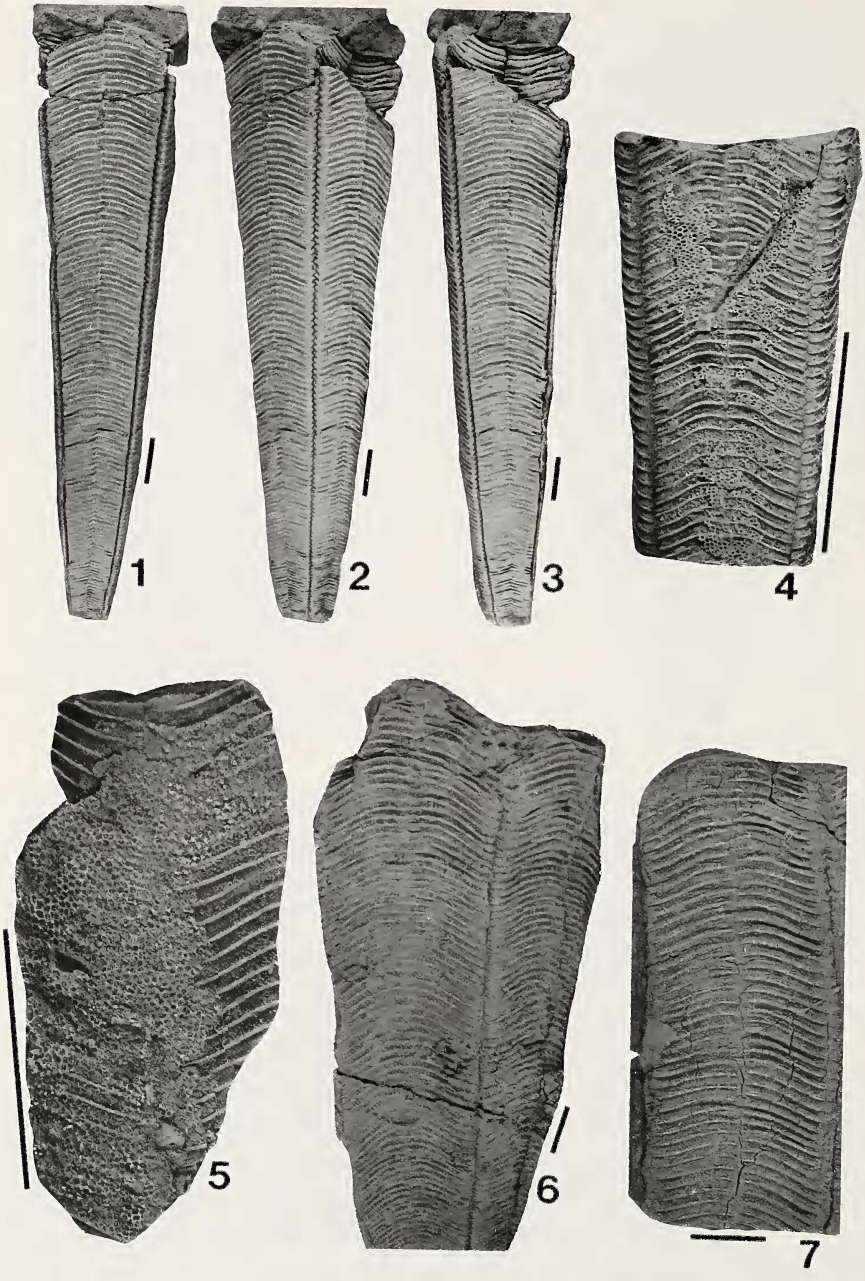
preserved in a phosphatic concretion. Arrow indicates a stalk; locality 184. 21.2; CMNH 4294, partially disarticulated paratype; locality 183. 21.3; *P. missouriensis* (Swallow), FMNH UC 1125, view of major face; locality 14. 21.4; *P. subulata* (Hall), USNM 395829, preserved in a very dark gray, organic-rich shale. Note that no integument is present and that rods are disarticulated. This specimen indicates that rods and integument are separate components of the conulariid exoskeleton. Two specimens of "*Lingula*" (=*Barroisella*?) are visible in this photograph; locality 189. Bar scales in Figs. 21.2–21.4 represent 1 cm; bar scale in Fig. 21.1 represents 5 mm.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cock and Feldmann, new species. Neither of these taxa have rod spacing values less than 14 rods/mm or adapical spines on the rods and are therefore easily distinguished from *P. missouriensis*. Moreover, *P. alpensis* possesses non-recurved rods in the apical region, unlike *P. missouriensis*.

The species *Conularia gratiosa* Miller and Gurley, *C. greenei* Miller and Gurley and *P. sciotovillensis* Driscoll are here included as junior synonyms of *C. missouriensis* because they all exhibit: 1, similar values for apical angles; 2, similar values for rod angles; 3, same rod articulation style, including right superior rods if the rods alternate at the midline; 4, similar values for rod spacing; 5, similar values for nodes/mm; and 6, presence of adapical spines. Comparative values are given in Appendix B.

Material examined.— 30 specimens; housed in the AMNH, FMNH, GSC, ISGS, and the USNM.

PARACONULARIA OKLAHOMAENSIS

Babcock and Feldmann, new species
Fig. 27.5

Description.—Description based only upon holotype. Exoskeleton 5.4 cm in length. Major apical angle 19°; minor apical angle 17°. Rod articulation of gothic arch style in apical end and of inflected circular curve style elsewhere. Rods usually abut at midline; if they alternate, pattern is usually right superior on major face and left superior on minor face; rod angle 12–13°. 24 rods/cm in apical region, 12 rods/cm elsewhere. Nodes and spines absent. Apical wall not observed.

Occurrence.—Upper Mississippian of Oklahoma; locality 229.

Type.—Holotype, USNM 409811.

Remarks.—*Paraconularia oklahomaensis* Babcock and Feldmann, n. sp. differs from all other described species of the genus in the combination of rod articulation pattern, frequent rod abuttment, spacing of rods, with 24 rods/cm in the apical region and 12 rods/cm elsewhere and the lack of nodes and spines on the rods.

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Fig. 22.—22.1–22.3; *Paraconularia blairi* (Miller and Gurley). 22.1; AMNH 25056, specimen intended by Sinclair (1948) to be holotype of *P. indiana* Sinclair, major face; locality 32. 22.2; AMNH 25056, same specimen as in Fig. 22.1, corner view. 22.3; AMNH 25056, same specimen as in Fig. 22.3, minor face. Note overturned apertural termination. 22.4–22.7; *P. chesterensis* (Worthen). 22.4; IUPC 17414, bryozoan-encrusted specimen; locality 1. 22.5; IUPC 17415, corner region of collapsed specimen that has been encrusted by bryozoans subsequent to collapse; locality unknown. 22.6; FMNH UC 23023; locality 38. 22.7; IUPC 11316; locality 57. Bar scales represent 1 cm.

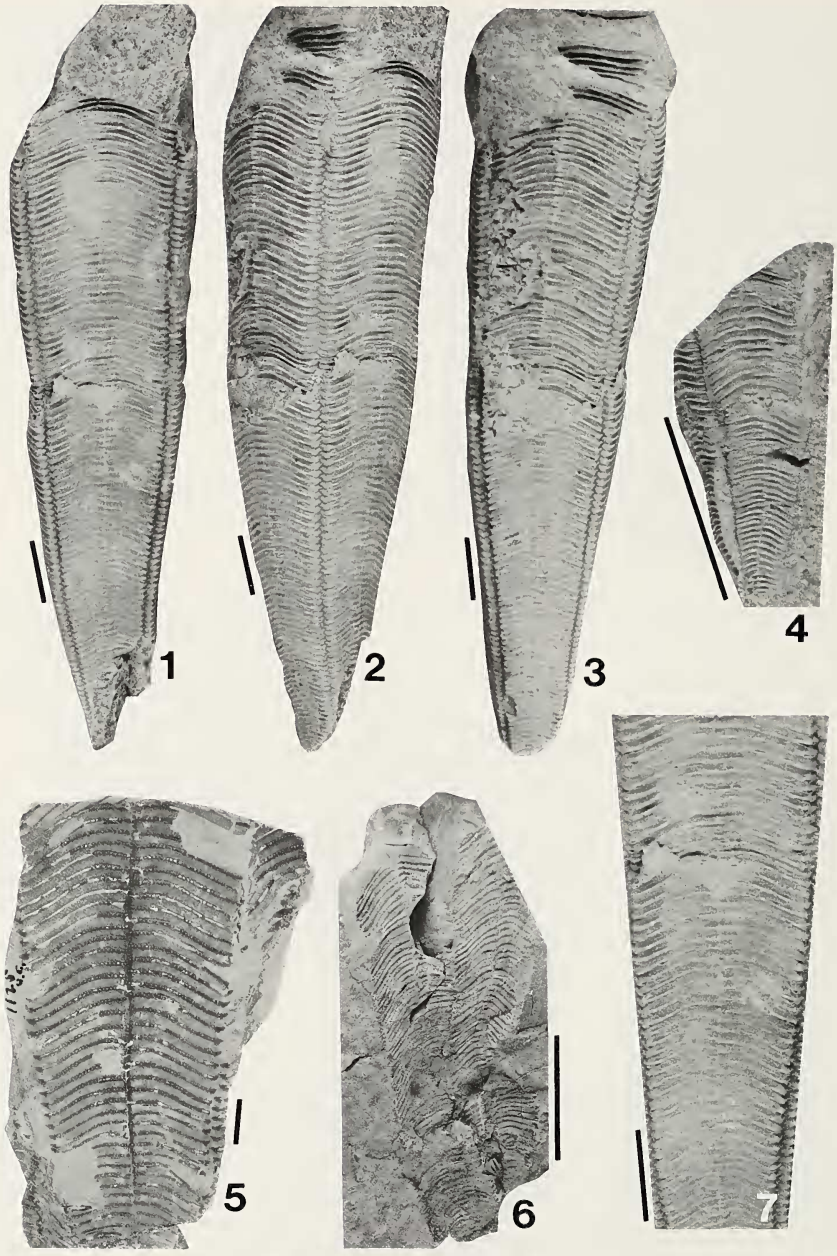

Fig. 23.—23.1–23.4; *Paraconularia chesterensis* (Worthen). 23.1; ISGS 2489, holotype, preserved in micritic to sparry limestone, minor face; locality 10. 23.2; ISGS 2489, same specimen as in Fig. 23.1, corner view. 23.3; ISGS 2489, same specimen as in Fig. 23.1,

This taxon is easily confused with *P. subulata* (Hall), which also lacks nodes and spines on the rods and has inflected gothic arch rod articulation in the apical region and inflected circular curve rod articulation elsewhere. The rods of *P. oklahomaensis,* however, are greatly inflected in the vicinity of the corner angles in the apical region and almost imperceptibly inflected elsewhere. In specimens of *P. subulata,* the pattern of relative inflexure of the rods is reversed. *Paraconularia oklahomaensis* is further distinguished from *P. subulata* in having 40–50% of the rods abutting at the midline whereas specimens referred to *P. subulata* seldom have more than 10% of the rods abutting.

Material examined.—1 specimens, USNM 409811.

Etymology of trivial name.—Named for the State of Oklahoma.

PARACONULARIA PLANICOSTATA (Dawson, 1868)
Figs. 3.1, 27.1–27.4, 27.6–27.8

Conularia planicostata Dawson, 1868, p. 307–308, fig. 117; Dawson, 1878, p. 307–308, fig. 117; Bigsby, 1878, p. 316; Dawson, 1883, p. 416; Lesley, 1889, p. 145, fig.; Beede, 1911, p. 174, 186; Bell, 1929, p. 98–100, Pl. 32, figs. 1–2; Bamber and Copeland, 1976, Pl. 15, fig. 3.

Conularia planocostata (*sic*) Dawson. Miller, 1877, p. 141; Miller, 1889, p. 390; Weller, 1898, p. 191.

Conularia quadrisulcata Miller *in* Sowerby. *Sensu* Dawson, 1889, p. 87, fig.

Conularia sorrocula Beede. *Sensu* Bell, 1929, p. 100, Pl. 32, figs. 3–3a.

Conularia cf. *tenuis* Slater. *Sensu* Bell, 1929, p. 100, Pl. 32, figs. 4–5.

Paraconularia planicostata (Dawson). Sinclair, 1948, p. 199–200; Babcock and Feldmann, 1984, p. 16–17; Babcock and Feldmann, 1986, fig. 2G.

Connularia (sic) *planicostata* Dawson. Alison and Carroll, 1972, p. 17.

Description.—Exoskeleton up to 8 cm in length. Major apical angle 21–25°; minor apical angle 18–22°. Rod articulation inflected gothic arch style in apical region and gothic arch style elsewhere. Rods abut or alternate at midline; if they alternate, rod pattern is usually right superior; rod angle 11–16°. 12–20 rods/cm. Nodes and spines absent. Apical wall not observed.

Occurrences.—Lower to Upper Mississippian of Nova Scotia and Quebec; localities 163–173 and 248.

Types.—Holotype, RM(MU) 2749, plastoholotype, GSC unnumbered.

Remarks.—*Paraconularia planicostata* (Dawson) is distinguished

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major face. 23.4; FMNH UC 25175; small specimen preserving apical region; locality 12. 23.5–23.6; *P. missouriensis* (Swallow). 23.5; FMNH UC 1125; specimen preserved in micrite showing darkened areas in the integument along the midline and surrounding the ridges. Darkened areas of integument in the vicinity of the midline have been interpreted by numerous authors as remains of original color markings. Specimen not coated with ammonium chloride; locality 14. 23.6; USNM 14425, original of Walcott (1884, Pl. 23, fig. 4), locality 110. 23.7; *P. chesterensis* (Worthen), ISGS 2489, same specimen as in Fig. 23.1, detail of minor face. Bar scales represent 1 cm.

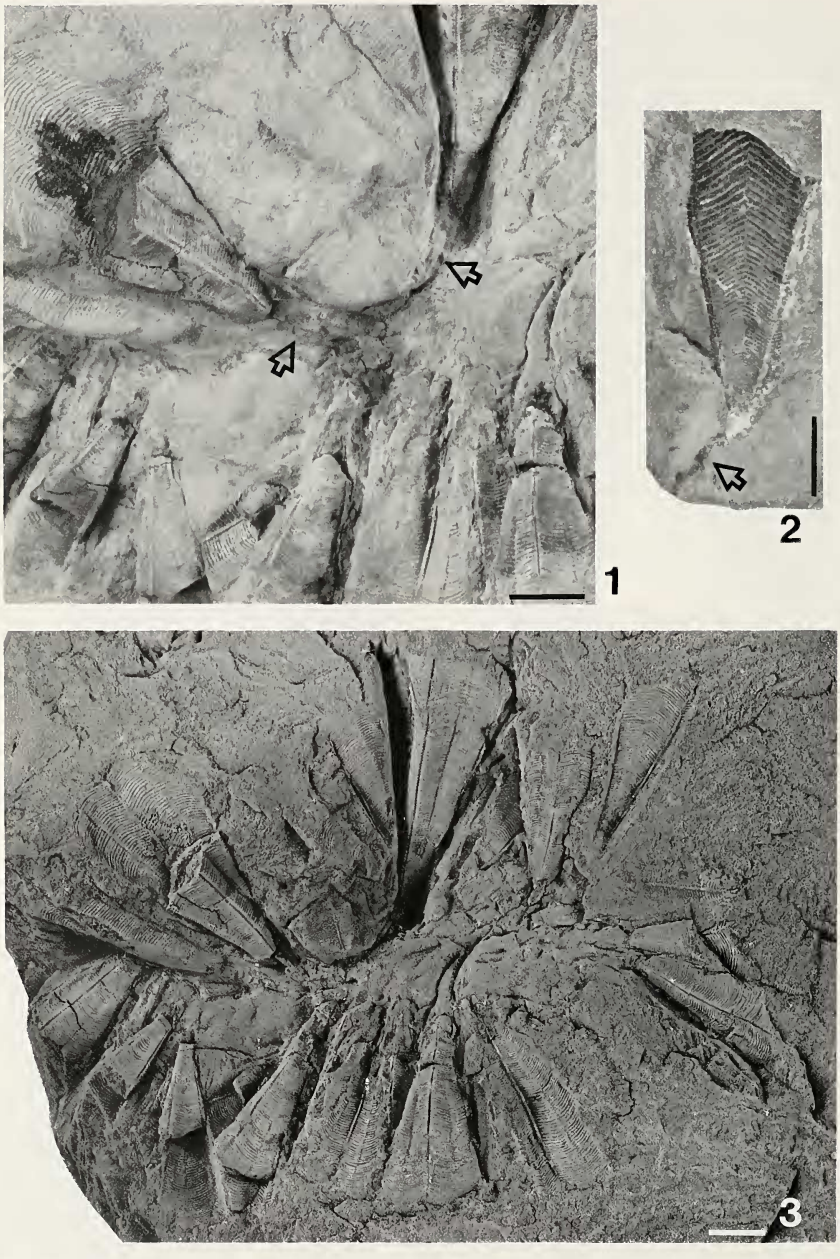

Fig. 24.—24.1; *Paraconularia chesterensis* (Worthen), USNM 50150, portion of large cluster of individuals preserved in siltstone and showing incomplete remains of stalks

from other members of the genus by the combination of: 1, its small size, generally less than 7.5 cm in length; 2, its inflected gothic arch and gothic arch rod articulation styles; 3, its very narrow apical angles, 8–14°; 4, its widely spaced rods, 12–20 rods/cm; and 5, its lack of nodes and spines. *Paraconularia planicostata* is particularly notable, and easily distinguished from all other taxa described herein because it possesses gothic arch rod articulation up to 7.5 cm from the hypothetical apex in the adapertural direction.

Dawson (1868, p. 308), in describing the species *Conularia planicostata,* compared the taxon to an apparent manuscript species, *C. novascotica* Hartt. Dawson considered this taxon, also from the Mississippian of Nova Scotia, to be a variety of *C. planicostata.* The intended holotype specimen of *C. novascotica* is lost, but based upon Hartt's scant description (*in* Dawson, 1868), it is likely to be an example of *P. planicostata* (Dawson).

Material examined.—30 specimens; housed in the CM, GSC, NYSM, RM(MU), and the USNM.

PARACONULARIA RECURVATUS

Babcock and Feldmann, new species

Figs. 32.3, 32.6

Description.—Exoskeleton up to 8 cm in length. Major apical angle about 16°; minor apical angle about 15°. Rod articulation exclusively of inflected circular curve style, greatly recurved near midline in apical region and slightly recurved near midline elsewhere. Rods abut or alternate at midline; if they alternate, pattern is usually left superior; rod angle 8–12°. 18–28 rods/cm. 2–3 nodes/mm; spines absent. Apical wall not observed.

Occurrence.—Upper Devonian of Nevada; locality 109.

Types.—Holotype, part and counterpart, USNM 409806. Three paratypes, USNM 409807–409809, all present on the same slab as the holotype. The paratype labelled as USNM 409808 is preserved as part and counterpart.

Remarks.—*Paraconularia recurvatus* Babcock and Feldmann, n. sp. is unique among members of this genus in having rods which are both closely spaced and which are recurved near the midline. Three other species of *Paraconularia* examined in this study have recurved rods, namely, *P. alpenensis* Babcock and Feldmann, n. sp., *P. chesterensis*

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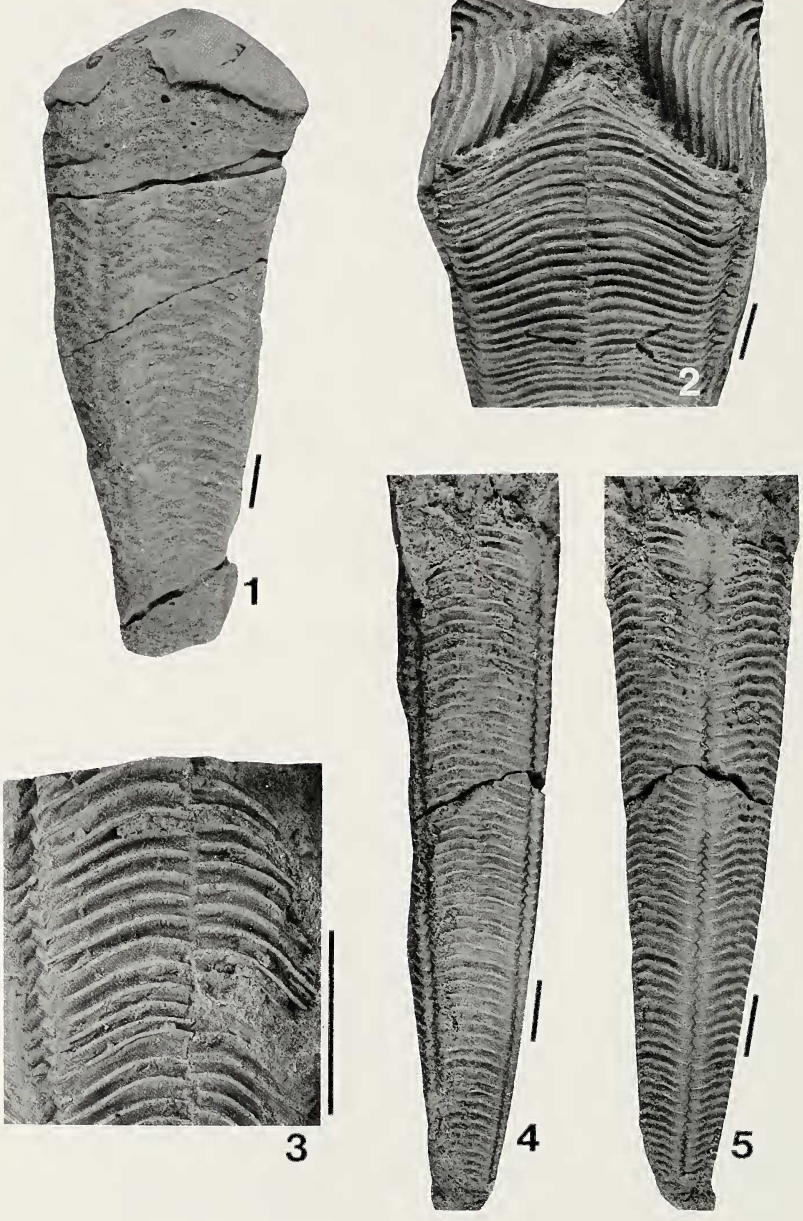
(arrows), attached to possible plant matter. Specimen not coated with ammonium chloride; locality 27. 24.2; *Paraconularia byblis* (White), USNM 409800, specimen preserved in siderite concretion and showing a stalk (arrow); locality 71. Specimen not coated with ammonium chloride. 24.3; *P. chesterensis* (Worthen), USNM 50150, same specimen as in Fig. 24.1, view showing the complete aggregation of conulariids as exposed at the surface of the slab. Bar scales represent 1 cm.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(Worthen) and *P. missouriensis* (Swallow). *Paraconularia recurvatus* differs from all of these forms in rod spacing. Specimens in the type lot of *P. recurvatus* have 18–28 rods/cm while the holotype of *P. alpenensis* has 14 rods/cm, specimens of *P. chesterensis* have 8–25 rods/cm and specimens of *P. missouriensis* have 6–10 rods/cm.

In its overall appearance, it seems as though *P. recurvatus* could be mistakenly included in the genus *Conularia*. However, the lack of spines indicates that this species should be included in the genus *Paraconularia*. All quantitative data (Appendix B) further support this conclusion.

Material examined.—4 specimens; housed in the USNM.

PARACONULARIA SALINENSIS (Whiteaves, 1891)
Figs. 28.3, 28.5–28.6

Conularia salinensis Whiteaves, 1891, p. 244, Pl. 32, figs. 9–9a.
Conularia s.l. *salinensis* Whiteaves. Sinclair, 1948, p. 287.

Description.—Description based only upon holotype. Exoskeleton 3 cm in length. Major apical angle approximately 24°; minor apical angle 21°. Rod articulation inflected gothic arch style in apical region and inflected circular curve style elsewhere. Rods usually alternate at midline; if they alternate, pattern is usually right superior on major and minor faces; rod angle 13° in apical region, 8° elsewhere. 24 rods/cm. 3–4 nodes/mm; 3–4 prominent adapertural spines/mm; adapical spines absent. Apical wall not observed.

Occurrence.—Mississippian of Alberta; locality 3.

Type.—Holotype, GSC 4292.

Remarks.—This taxon can be distinguished from other species of *Paraconularia* by the combination of: 1, inflected gothic arch and inflected circular curve styles of rod articulation; 2, apical angles of 8–13°; 3, rod spacing of 24 rods/cm; 4, node spacing of 3–4 nodes/mm; and 5, prominent adapertural spines. *Paraconularia salinensis* (Whiteaves) does not seem to be easily confused with any other conulariid species described to date from the Devonian or Mississippian rocks of North America.

Material examined.—1 specimen, GSC 4292.

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Fig. 25.—*Paraconularia missouriensis* (Swallow). 25.1; FMNH UC 6639, plaster cast of presumed holotype specimen; locality 100. 25.2; ISGS 2619; oblique view of specimen with three inturned apertural terminations. The fourth apertural termination is broken off, but there is no indication of infolding. 25.3; UMMP 26740, holotype of *P. sciotovillensis* Driscoll, same specimen as in Fig. 26.1, detail of major face; locality 226. 25.4; FMNH UC 6628, holotype of *Conularia greenei* Miller and Gurley; minor face of a specimen preserved in micrite. 25.5; FMNH UC 6628, same specimen as in Fig. 25.4, corner view. Bar scales represent 1 cm.

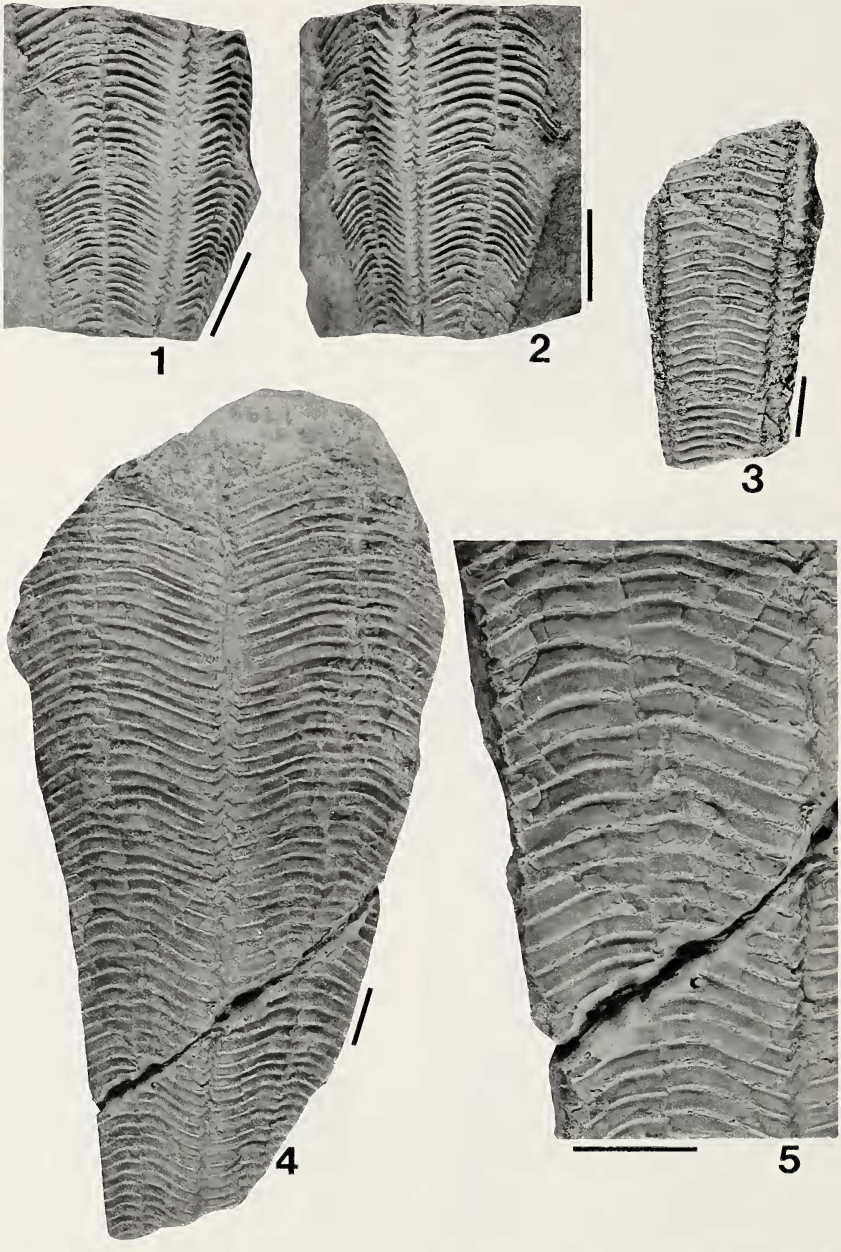

Fig. 26.—*Paraconularia missouriensis* (Swallow). 26.1; UMMP 26740, holotype of *P. sciotovillensis* Driscoll, minor face of a somewhat distorted individual preserved in a

PARACONULARIA SORROCULA (Beede, 1911)
Figs. 28.1–28.2

Conularia sorrocula Beede, 1911, p. 184, 186, 2 figs.
Paraconularia sorrocula Beede. Sinclair, 1948, p. 199.

Description.—Exoskeleton up to 3 cm in length. Major apical angle 19–24°; minor apical angle 17–22°. Rod articulation exclusively inflected gothic arch style with slight adapertural inflection at midline. Rods usually alternate at midline, less frequently they abut; rods, if they alternate, pattern is usually left superior on both major and minor faces; rod angle 11–14°. 18–20 rods/cm. Nodes elongate and appear to be continuous structures with adapertural spines; 5–6 nodes/mm; 5–6 adapertural spines/cm. Adapical spines absent. Apical wall not observed.

Occurrence.—Mississippian of Quebec; locality 247.

Type.—Holotype, part and counterpart, NYSM 9414.

Remarks.—*Paraconularia sorrocula* (Beede) is unique among North American Devonian or Mississippian examples of *Paraconularia* in the possession of only inflected gothic arch rod articulation. It is also the only conulariid species reported herein which has the nodes merged with the adapertural spines without a significant change at the junction of the two structures (Fig. 28.2). The nodes are not round or oblate in outline as in other species of *Paraconularia,* but are elongate.

The holotype of *P. sorrocula* is curved in the apertural region. This feature may have been present on the specimen in life, although this cannot be confirmed owing to the crushed nature of the fossil.

Material examined.—3 specimens; housed in the NYSM.

PARACONULARIA SUBULATA (Hall, 1858)
Figs. 3.2, 3.5–3.6, 21.4, 29.1–29.10, 30.1–30.8, 31.1–31.5, 33.4

Conularia subulata Hall, 1858, p. 32; Miller, 1877, p. 141; Bigsby, 1878, p. 316; Whitfield, 1882, p. 91, Pl. 8, fig. 3; Hall, 1883, p. 372–373, Pl. 31, fig. 3; Miller, 1889, p. 390; Lesley, 1889, p. 146, fig.; Lesley, 1895, p. 1690, fig.; Weller, 1898, p. 192; Whitfield and Hovey, 1901, p. 406–407; Cumings, 1906, p. 1366, Pl. 25, fig. 3.
Conularia victa White, 1862, p. 22–23; Miller, 1877, p. 141; Bigsby, 1878, p. 316; Miller, 1889, p. 390; Herrick, 1893, Pl. 19, fig. 3; Weller, 1898, p. 192.
Conularia newberryi Winchell, 1865, p. 130; Winchell, 1870, p. 258; Meek, 1875, p. 316–317, Pl. 18, fig. 2a–b; Miller, 1877, p. 141; Bigsby, 1878, p. 316; Hall, 1879, Pl. 34A, fig. 12; Herrick, 1888*a*, p. 93–94, Pl. 6, figs. 13, 17, Pl. 8, fig. 9; Herrick,

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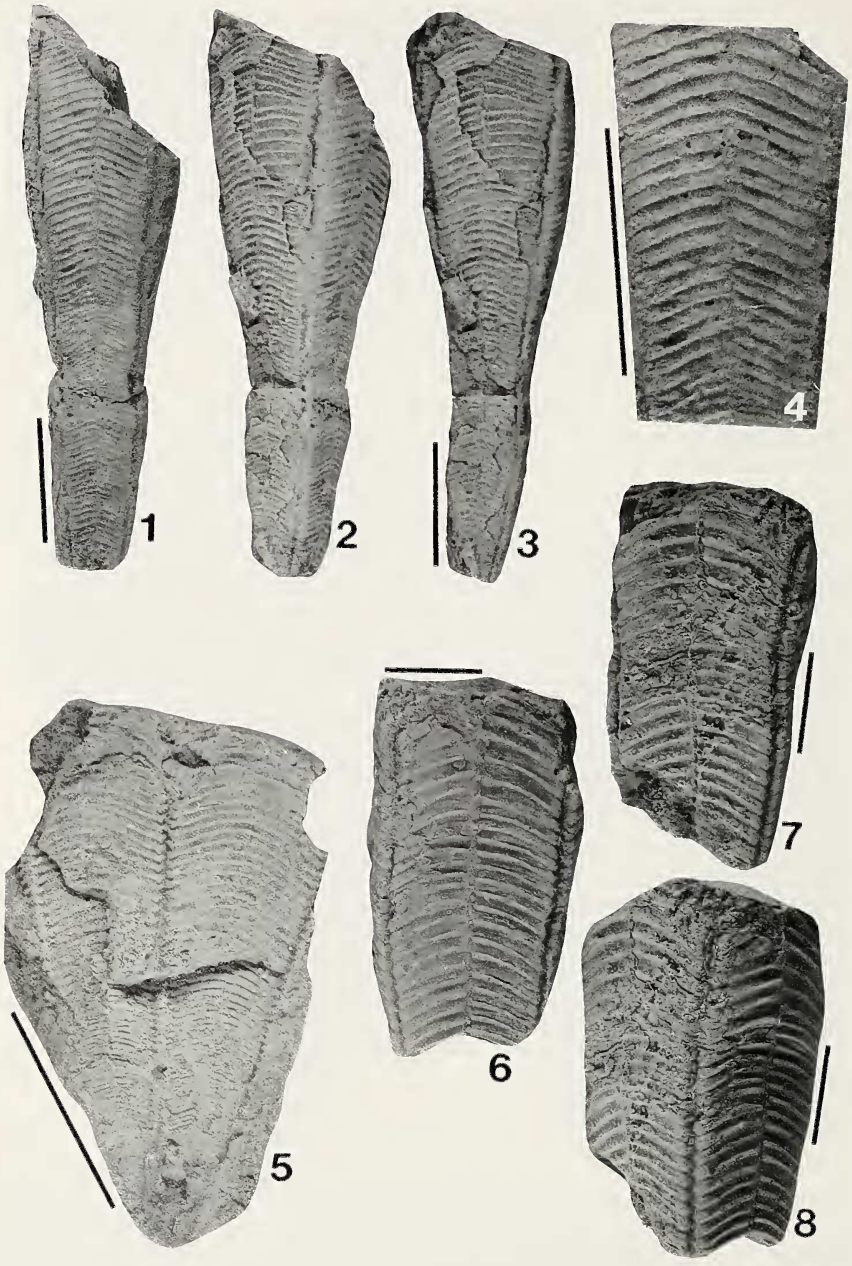
siderite concretion; locality 226. 26.2; UMMP 26740, same specimen as in Fig. 26.1, major face. 26.3; AMNH 28692, minor face of a specimen preserved in sparry limestone; locality 30. 26.4; FMNH UC 6627, holotype of *Conularia gratiosa* Miller and Gurley, preserved in micritic limestone, corner view; locality 30. 25.5; FMNH UC 6627, same specimen as in Fig. 26.4, detailed view of a minor face. Bar scales represent 1 cm.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1888*b*, Pl. 8, fig. 5, Pl. 10, figs. 27–28; Lesley, 1889, p. xv; Miller, 1889, p. 390; Herrick, 1893, Pl. 19, fig. 5; Miller, 1897, p. 765; Weller, 1898, p. 191; Clarke and Ruedemann, 1903, p. 566; Grabau and Shimer, 1910, p. 13, figs. 1227a–b; Tasch, 1973, fig. 5.16, Table 5.2; Tasch, 1980, fig. 5.16, Table 5.2.

Conularia whitei Meek and Worthen, 1865, p. 253–254; Bigsby, 1878, p. 316.

Conularia newberryi Winchell? Herrick, 1887, p. 146–147, Pl. 14, fig. 14.

Conularia victa White? Herrick, 1888*b*, p. 47–48, Pl. 8, fig. 3.

Conularia whitii (*sic*) Miller, 1889, p. 390; Weller, 1898, p. 192.

Conularia sampsoni Miller, 1892*a*, p. 690–691, Pl. 14, figs. 11–12; Miller, 1892*b*, p. 692; Holm, 1893, p. 125; Weller, 1898, p. 191; Branson, 1938, p. 110–111, Pl. 14, fig. 9; Branson, 1944, p. 216.

Paraconularia subulata (Hall). Sinclair, 1948, p. 198; Babcock and Feldmann, 1986, figs. 1C–D, 1G, 2F, 3A–C.

Paraconularia victa (White). Sinclair, 1948, p. 200.

Paraconularia newberryi (Winchell). Sinclair, 1948, p. 191–192; Driscoll, 1963, p. 34–37, Pl. 1, figs. 1–5, Pl. 2, figs. 1–4.

Paraconularia whitei (Meek and Worthen). Sinclair, 1948, p. 192.

Paraconularia sampsoni Miller. Sinclair, 1948, p. 197.

Paraconularia sp. Feldmann, Coogan and Heimlich, 1977, fig. 2.50A.

"*Conularia*" sp. Thompson, 1982, fig. 357.

Paraconularia cf. *P. missouriensis* (Swallow). *Sensu* Babcock, 1985*a*, figs. 1a–b.

Paraconularia missouriensis (Swallow). *Sensu* Babcock, 1985*a*, fig. 2.

Paraconularia cf. *P. subulata*. Babcock and Feldmann, 1986, fig. 2H.

Description.—Exoskeleton up to 17 cm in length. Major apical angle 17–22°; minor apical angle 12–18°. Rod articulation inflected gothic arch style in apertural region and inflected circular curve style elsewhere. Rods usually alternate at midline; if they alternate, pattern is usually right superior on major face and usually left superior on minor face; rod angle 15–18°. 20–35 rods/cm. Nodes absent or present; if present, they are inconspicuous, 2–3/mm; spines absent. Apical wall present.

Occurrences.—Lower Mississippian of Illinois, Indiana, Kentucky, Montana, Ohio; localities 16, 26, 29, 38, 39, 72, 75, 82, 106–107, 185–192, 194, 196–203, 205–208, 212–217, 220–222.

Types.—Lectotype, designated herein from James Hall's suite of three syntypes of *C. subulata*, AMNH 32403, smaller of two specimens bearing this number; two paratypes, AMNH 32403, larger of two specimens bearing this number, and AMNH 32404. Holotype of *C. victa*,

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Fig. 27.—27.1–27.4; *Paraconularia planicostata* (Dawson). 27.1; RM(MU) 2749, holotype; major face, locality 164. 27.2; RM(MU) 2749, same specimen as in Fig. 27.1, corner view. Note exoskeletal constrictions. 27.3; RM(MU) 2749, same specimen as in Fig. 27.1, minor face. 27.4; RM(MU) 2749, same specimen as in Fig. 27.1, detail of major face. 27.5; *P. oklahomaensis* Babcock and Feldmann, n. sp., USNM 409801, holotype, a flattened individual. 27.6–27.8; *P. planicostata* (Dawson). 27.6; CM 22667, major face; locality 168. 27.7; CM 22667, same specimen as in Fig. 27.6, minor face. 27.8; CM 22667, same specimen as in Fig. 27.6, corner view. Bar scales in Figs. 27.1–27.5 represent 1 cm; bar scales in Figs. 27-6–27.8 represent 5 mm.

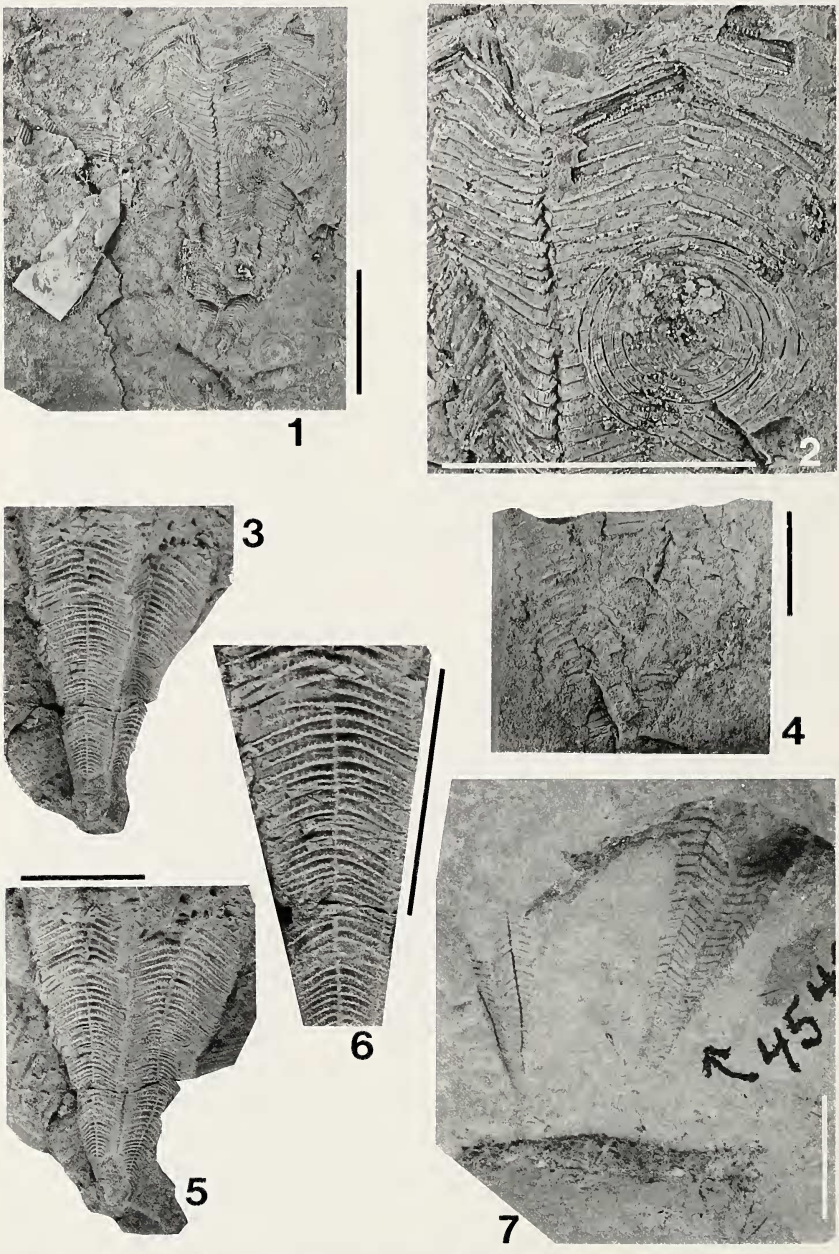

Fig. 28.—28.1–28.2; *Paraconularia sorrocula* (Beede). 28.1; NYSM 9414, slab showing two specimens, holotype to the right. Note orbiculoid brachiopods attached to, and

UMMP 2178, plastoholotype, GSC unnumbered; holotype of *C. newberryi,* UMMP 245; holotype of *C. whitei,* UIPC 10866; holotype of *C. sampsoni,* FMNH UC 6961, plastoholotype, USNM 68156.

Remarks.—*Paraconularia subulata* (Hall) is most similar in morphology to *P. oklahomaensis* Babcock and Feldmann, n. sp. Both taxa have inflected gothic arch rod articulation in the apical region and inflected circular curve rod articulation elsewhere. Also, specimens referable to both taxa may lack nodes and spines. Except for rod spacing values, the quantitative measures are also very similar. *Paraconularia subulata* has a rod spacing of about 20–35 rods/cm whereas the holotype of *P. oklahomaensis* has a value of 12–24 rods/cm. *Paraconularia subulata* differs most substantially from *P. oklahomaensis* in having very little inflection of the rods in the vicinity of the apex and in having a strong inflection of the rods elsewhere.

In addition to *P. oklahomaensis, P. blairi* (Miller and Gurley) bears close similarity to *P. subulata.* Both taxa have inflected gothic arch rod articulation adapically and inflected circular curve rod articulation adaperturally. Apical angles and rod angles are nearly equal in the two forms. *Paraconularia subulata* differs from *P. blairi* in its lack of nodes on the rods or in having inconspicuous nodes, in the lack of any adapertural inflection of the rods near the midline and in the possession of a greater number of rods/cm, 20–35 as compared to 6–8.

The species *P. victa* (White), *P. newberryi* (Winchell), *P. whitei* and *P. sampsoni* (Miller) are all included as junior synonyms of *P. subulata* because they are indistinguishable from the lectotype and paralectotypes of *P. subulata.* The type specimens of all these species bear subtle nodes on the rods; all have apical angles in the range of 12–22°; all have inflected gothic arch styles of rod articulation; all have 20–35 rods/cm; and all have rod angles of 15–18°. The holotype of *P. sampsoni* possibly could be construed as a juvenile of *P. blairi,* but the lack of rods which are slightly inflected at the midline makes assignment of this specimen to *P. subulata* more reasonable.

Paraconularia subulata is one of the most abundant conulariids in

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located near, the conulariids; locality 247. 28.2; NYSM 9414, same specimen as in Fig. 28.1, detail of holotype. 28.3; *P. salinensis* (Whiteaves), GSC 4292, holotype, minor face; locality 3. 28.4; *P.* sp., CM 34531, a collapsed and poorly preserved specimen in tan and dark red colored dolostone; locality 249. 28.5–28.6; *P. salinensis* (Whiteaves). 28.5; GSC 4292, same specimen as in Fig. 28.3, corner view. 28.6; GSC 4292, same specimen as in Fig. 28.3, detail of minor face. 28.7; *P. yochelsoni* Babcock and Feldmann, n. sp., external molds of two specimens attached to plant matter, holotype, UMMP 45499, to the right, paratype, UMMP 65509, to the left; locality 93. Specimen is not coated with ammonium chloride. Bar scales represent 1 cm.

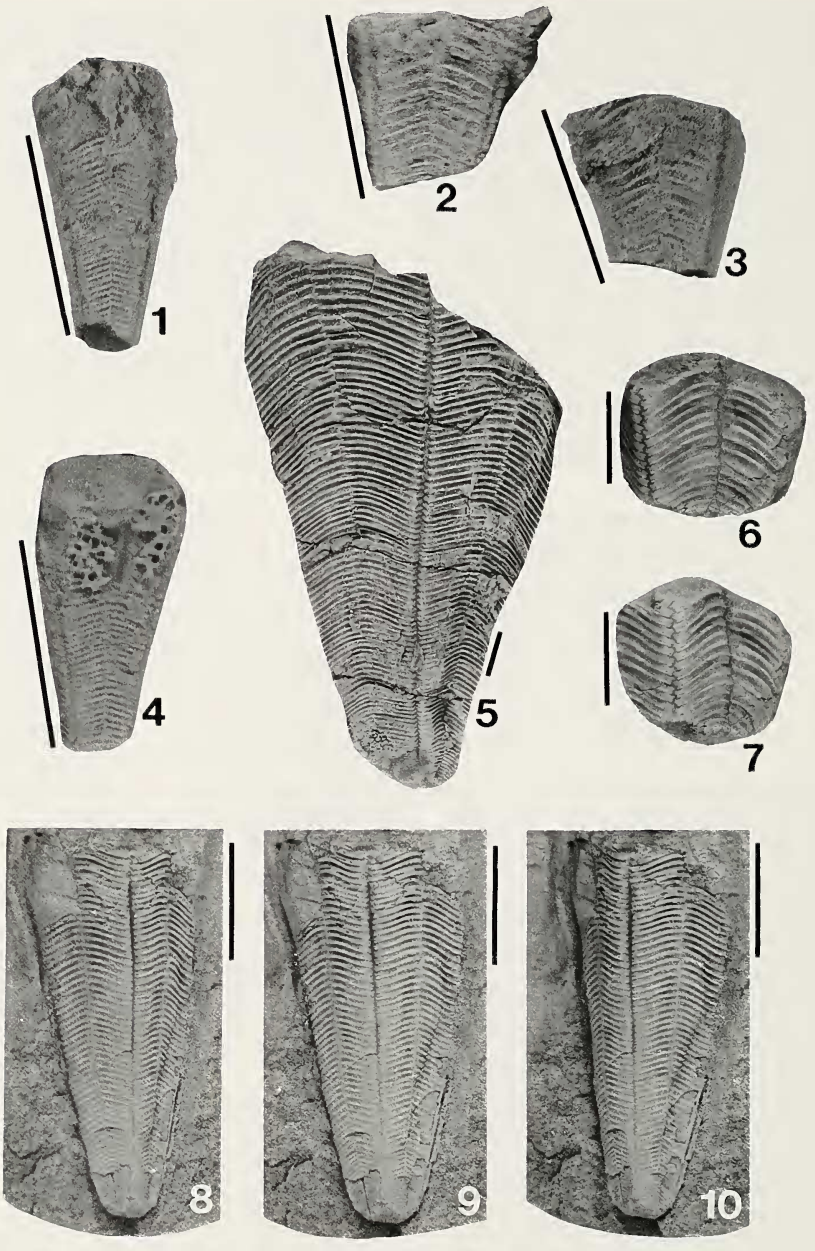

Fig. 29.—*Paraconularia subulata* (Hall). 29.1; AMNH 32404 (smaller of two specimens), lectotype, minor face; locality 16. 29.2; UMMP 245, holotype of *Conularia newberryi*

the Lower Mississippian of the North American midcontinent. It is often confused with other taxa, especially *P. missouriensis,* in museum collections. The reason for this confusion is not clear. Some specimens of this taxon, which superficially appear very similar to specimens of *P. blairi,* may have been confused with *P. missouriensis* because of ambiguity in Swallow's original description of the latter. It is likely that Swallow's description was based upon specimens now referable to both *P. missouriensis* and *P. blairi.*

Conulariids collected from the Bear Gulch Limestone of Montana (CM 34507–34527 and 35000) and from the Cameron Creek Shale of Montana (USNM 118731) are here assigned to *P. subulata* with little reservation. The specimens differ from the type series of *P. subulata* only in the uniform lack of nodes on the rods. However, samples of many specimens referable to *P. subulata* from Illinois, Ohio, and elsewhere indicate that nodes are frequently lacking in this taxon. Even when nodes are present on such specimens, they are subtle.

Material examined.—149 specimens; housed in the AMNH, CM, CMNH, FMNH, GSC, OC, UMMP, USNM, and the private collection of Ron Fisher.

PARACONULARIA WELLSVILLIA
Babcock and Feldmann, new species
Figs. 33.3, 33.6–33.8

Paraconularia sp. Babcock and Feldmann, 1986, fig. 2J.

Description.—Exoskeleton up to 13 cm in length. Major apical angle 14–18°; minor apical angle 12–15°. Rod articulation gothic arch style in apical region and inflected gothic arch style elsewhere; rods almost always alternate at the midline; if they alternate, pattern is usually left superior on major face and usually right superior on minor face; rod angle 26–31°. 4–5 rods/cm; 2–3 nodes/mm; 2–3 adapertural spines/mm; adapical spines appear not to be present. Apical wall not observed.

Occurrence.—Upper Devonian of New York; localities 161–162.
Types.—Holotype, CM 35001; 12 paratypes, CM 34538–34550.
Remarks.—*Paraconularia wellsvillia* Babcock and Feldmann, n. sp.

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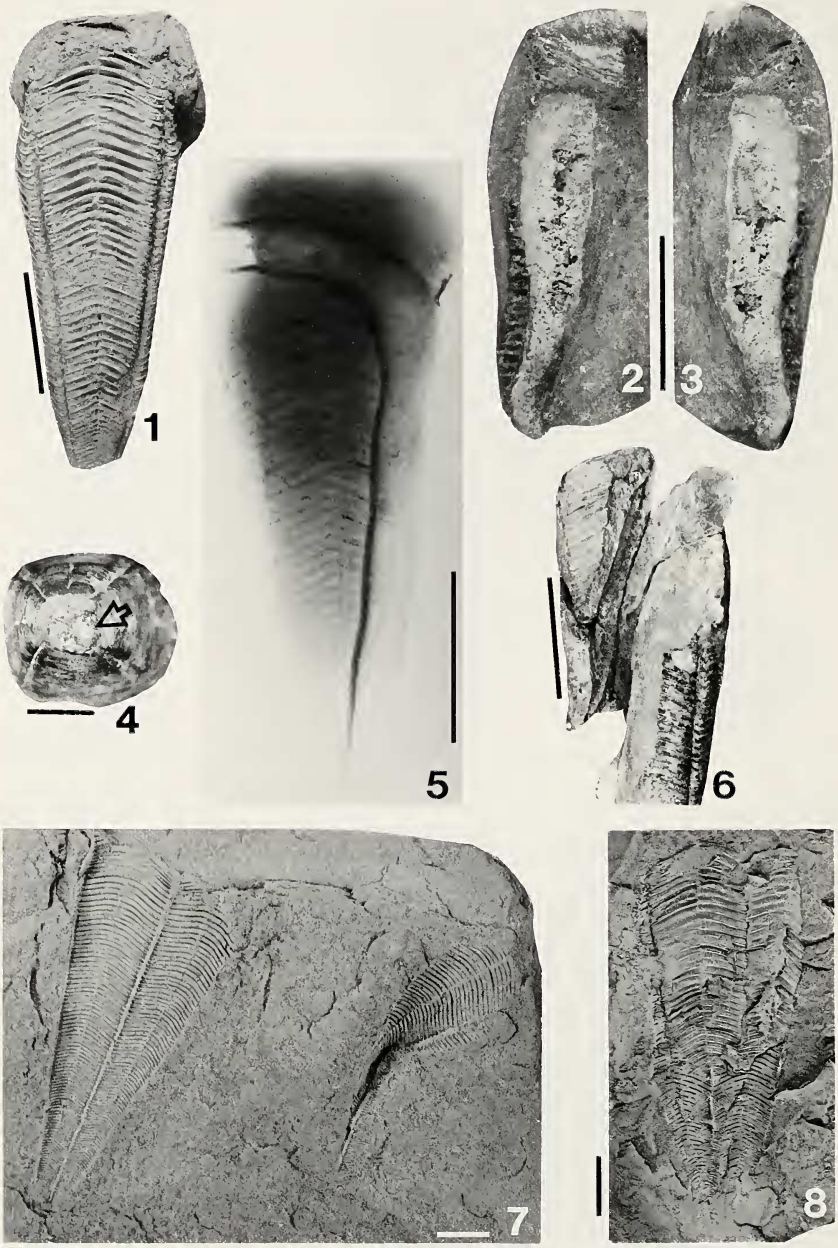
Winchell, major face; locality 206. 29.3; UMMP 245, same specimen as in Fig. 29.2, minor face. 29.4; AMNH 32404 (smaller of two specimens), same specimen as in Fig. 29.1, major face. The pitted material attached to the specimen is glue. 29.5; CMNH 5988, corner view of large, partially compressed specimen. Note healed injury near top of minor face; locality 198. 29.6; UMMP 2178, holotype of *C. victa* White, ?minor face; locality 63. 29.7; UMMP 2178, same specimen as in Fig. 29.6, corner view. 29.8; FMNH UC 6961, holotype of *C. sampsoni* Miller, minor face; locality 94. 29.9; FMNH UC 6961, same specimen as in Fig. 29.8, corner view. 29.10; FMNH UC 6961, same specimen as in Fig. 29.8, major face. Bar scale in Fig. 29.5 represents 1 cm; bar scales in Figs. 29.1–29.4 and 29.6–29.10 represent 5 mm.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is distinguished from all other species of *Paraconularia* known from the Devonian and Mississippian rocks of North America in having gothic arch rod articulation in the apical region and inflected gothic arch rod articulation elsewhere. Superficially, this taxon resembles *P. yochelsoni* in the general pattern of rod articulation near the aperture. *P. wellsvillia,* however, possesses nodes and adapertural spines whereas *P. yochelsoni* does not.

Of the 13 specimens examined and referred to *P. wellsvillia,* only the holotype, CM 35001, shows well preserved nodes and spines (Figs. 33.7–33.8). Others, such as the specimen illustrated in Fig. 33.6, seem to lack these structures. After examination of the holotype and 12 paratypes, it seems that two factors affect these profound preservational differences: 1, degree to which the integument is fit around the rods, nodes, and spines; and 2, type of lithology in which the specimen is preserved. The Wellsville Formation, from which all specimens in the type suite were collected, varies from a fine grained silty sandstone to a micaceous siltstone to a micaceous shale. Preservation of a conulariid tends to be better in a fine grained matrix.

The holotype of *P. wellsvillia* shows a wrinkling of the integument only partially related to the pattern of nodes and spines (Fig. 33.8). This wrinkling is also attributed, in part, to a tight fitting of the integument about the framework of the exoskeleton and slight displacement of the framework.

Material examined.—13 specimens; housed in the CM.

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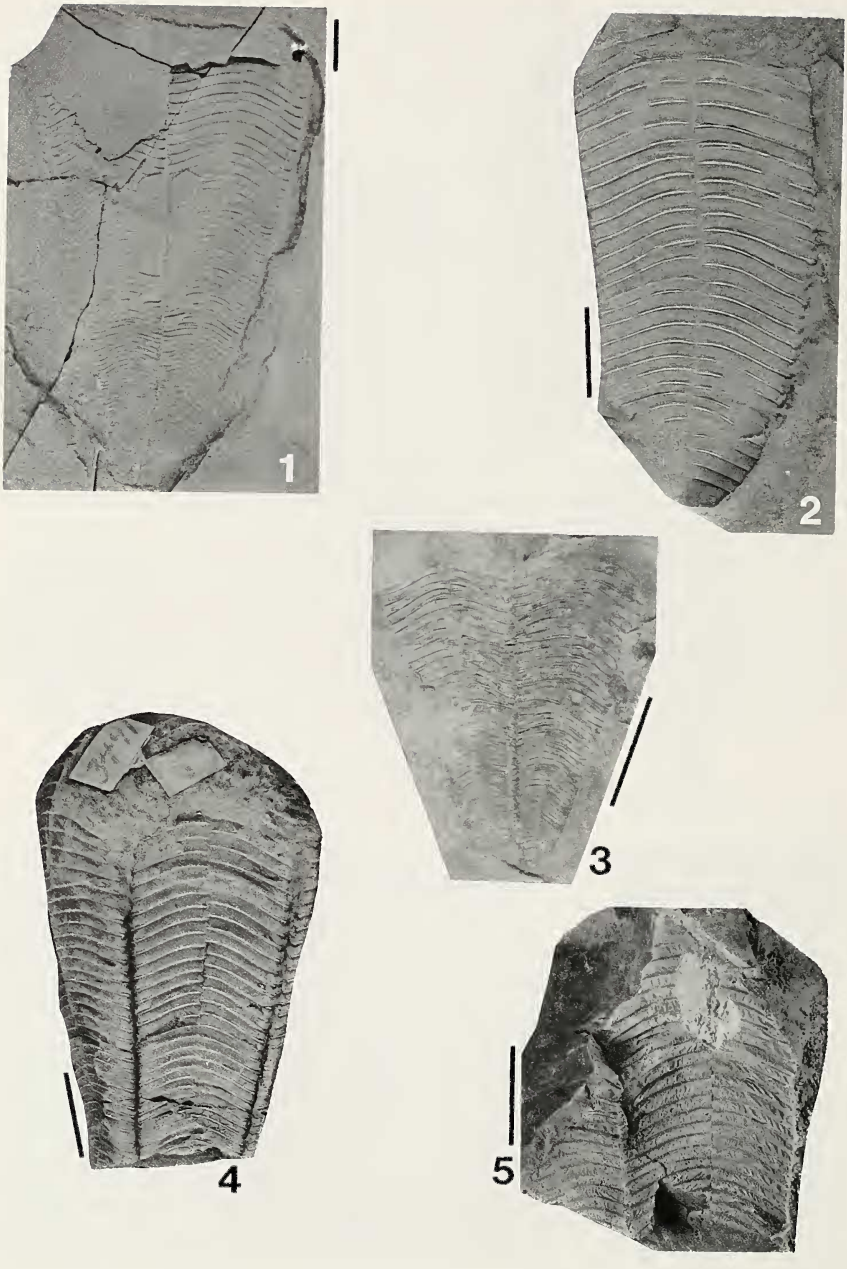
Fig. 30.—*Paraconularia subulata* (Hall). 30.1; USNM 409802, minor face of specimen preserved in phosphatic concretion; locality 72. 30.2–30.3; USNM 395828, right and left halves of a specimen preserved in a phosphatic concretion and showing internal soft-parts; locality 72. 30.4; USNM 409802, same specimen as in Fig. 30.1, view from apical end showing rounded cross section of soft-parts (arrow). 30.5; USNM 409802, same specimen as in Fig. 30.1, x-ray photograph of specimen preserved in a phosphatic concretion. The photograph was obtained using a Hewlett-Packard Faxitron Series x-ray unit located in the Department of Anthropology, Kent State University. The specimen is in the same orientation as in Fig. 30.1. Presumed internal soft-parts appear as a single, elongate tube. 30.6; USNM 409803, specimen preserved in a phosphatic concretion with some of the exoskeleton broken away, revealing remains of limonite-coated internal soft-parts. 30.7; USNM 409804, two specimens preserved in same orientation in siltstone block. Sole marks on reverse side of slab parallel the orientation of the conulariids and indicate that these specimens have been current aligned; locality 220. 30.8; UIPC 10866, holotype of *Conularia whitei* Meek and Worthen preserved in siderite; locality 201. Bar scales in Figs. 30.1–30.3 and 30.5–30.8 represent 1 cm; bar scale in Fig. 30.4 represents 5 mm. Specimens in Figs. 30.2–30.4 and 30.6 have not been coated with ammonium chloride.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Etymology of trivial name.—Named for the Wellsville Formation, from which the holotype specimen was collected.

PARACONULARIA YOCHELSONI

Babcock and Feldmann, new species
Figs. 28.7, 33.1–33.2, 33.5

Paraconularia newberryi (Winchell). *Sensu* Driscoll, 1963, p. 34–40, Pl. 1, figs. 6–8.

Description.—Exoskeleton up to 3.5 cm in length. Major apical angle 17–20°; minor apical angle approximately 18°. Rod articulation gothic arch style in earliest stages, inflected gothic arch style in later stages. Rods usually alternate at midline; if they alternate, pattern is usually right superior on both major and minor faces; rod angle 15–20°. 13–18 rods/cm. Nodes appear to be absent; spines absent. Apical wall present.

Occurrence.—Lower Mississippian of Michigan; locality 93.

Types.—Holotype, UMMP 45499; two paratypes, UMMP 65509 on the same slab as UMMP 45499, and UMMP 45500.

Remarks.—*Paraconularia yochelsoni* Babcock and Feldmann, n. sp. is only similar in morphology to *P. alternistriata* (Shimer). Both species seem to be less than 3.5 cm in maximum length, lack nodes on the rods and have rod articulation patterns which appear to be similar. *Paraconularia yochelsoni,* however, has larger apical angles, 15–20° as compared to 10–11°, and fewer rods/cm, 13–15 as compared to 28.

The holotype, UMMP 45499, and paratype, UMMP 65509, specimens of *P. yochelsoni,* are preserved as three dimensional specimens lacking the integument except along the midline. The midline may have been thickened in this taxon.

The holotype and paratype of *P. yochelsoni* are located on the same slab as a large portion of black, carbonaceous matter composed largely of densely packed, filamentous strands (Fig. 28.7). This material probably represents plant matter of some sort, perhaps a planktonic alga. The two conulariids appear to be attached to the presumed plant matter by stalks extending from their apices; only small traces of the stalks remain in place. The two conulariids on this slab are radiating away from the center of the dark mass.

Material examined.—3 specimens; housed in the UMMP.

Etymology of trivial name.—Named for Ellis L. Yochelson, a distinguished student of problematic fossils.

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Fig. 31.—*Paraconularia subulata* (Hall). 31.1; CM 34524, preserved in micrite; locality 106. 31.2; CM 35000, preserved in micrite; locality 106. 31.3; CM 34521, preserved in micrite, locality 106. 31.4; NYSM 3491, preserved in siderite; locality 203. Original of Hall's "*Conularia newberryi*" (1879, Pl. 34A, fig. 12). 31.5; USNM 118731; locality 107. Bar scales represent 1 cm.

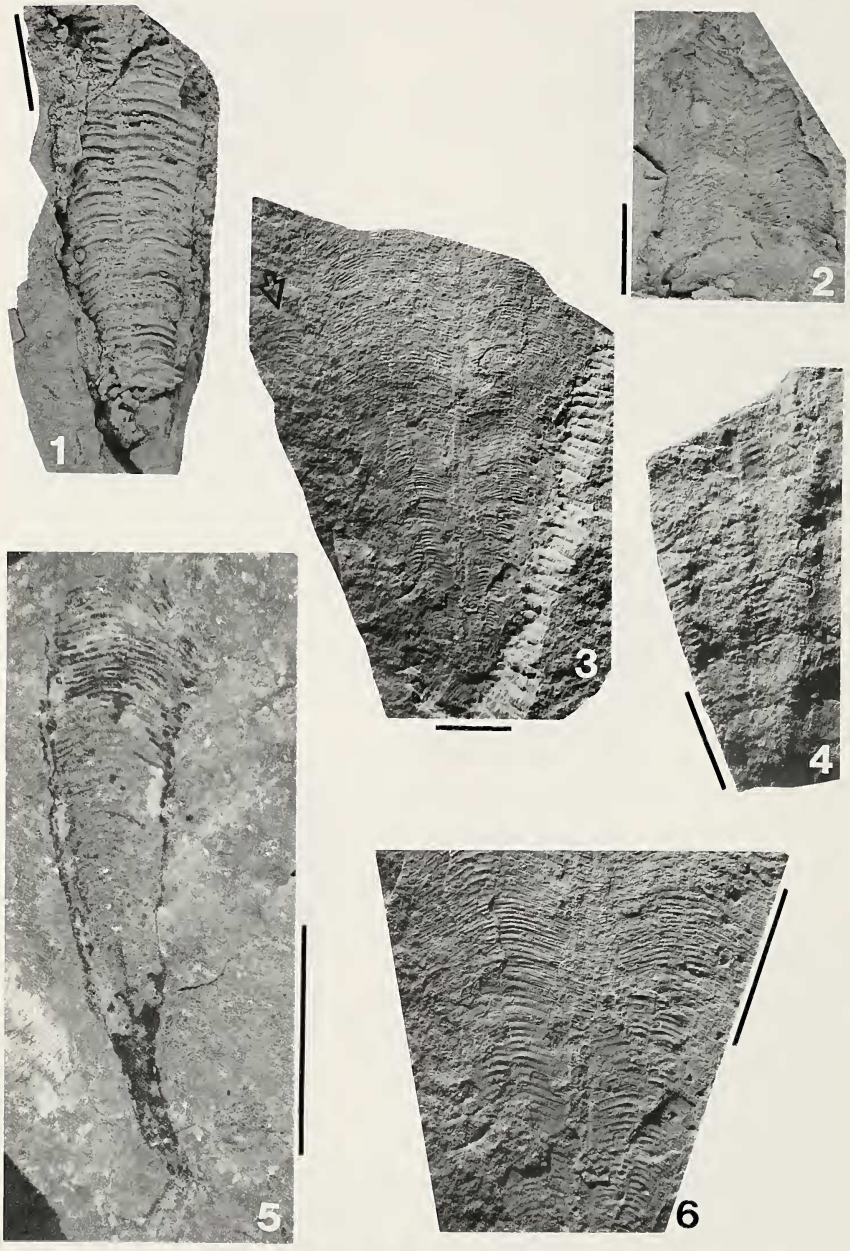

Fig. 32.—32.1; *Paraconularia missouriensis* (Swallow)?, GSC 85062; locality 5. 32.2; *P.* sp., USNM 409805, fragment of specimen lacking integument preserved in soft blue-

PARACONULARIA sp.
Fig. 28.4

Occurrence.—Upper Devonian-Lower Mississippian transition of South Dakota; locality 27.4.

Figured specimen.—CM 34531.

Remarks.—A single specimen of conulariid was collected from the Englewood Formation at Deadwood, South Dakota. It can be reliably identified only to the genus level.

The specimen is badly crushed and incomplete, making it possible to perform few qualitative or quantitative observations. The specimen in question possesses 7 rods/cm and lacks nodes and spines; it is therefore referred to the genus *Paraconularia.* The specimen seems to have a gothic arch style of rod articulation in the apical region and an inflected circular curve style elsewhere.

Species of *Paraconularia* examined in this work which may possess 7 rods/cm include *P. blairi* (Miller and Gurley) and *P. missouriensis* (Swallow); *P. chesterensis* (Worthen) can have as few as 8 rods/cm and *P. wellsvillia* Babcock and Feldmann, n. sp. has 4–5 rods/cm. Of these, CM 34531 appears to be most similar to *P. blairi* or *P. subulata* (Hall) in terms of rod articulation.

Material examined.—1 specimen, CM 34531.

RETICULACONULARIA Babcock and Feldmann, new genus

Diagnosis.—Conulariids with rods that are widely spaced, 12–39/cm. 30–80% of rods alternate at midline; 20–70% abut. Apical angles large, 22–59°. Nodes and adapertural spines present and widely spaced; adapical spines not known.

Type species.—*Conularia penouili* Clarke, 1907; Lower Devonian of Quebec. Holotype, NYSM 9412.

Remarks.—Species referable to *Reticulaconularia* differ from all other conulariids in having very large apical angles, 22–59° in the specimens measured in this study. The wide spacing between adjacent rods and between nodes, as well as between adapertural spines is also unique to species of this genus. In specimens retaining the external surface of the integument, this pattern of rods, nodes, and spines gives the exo-

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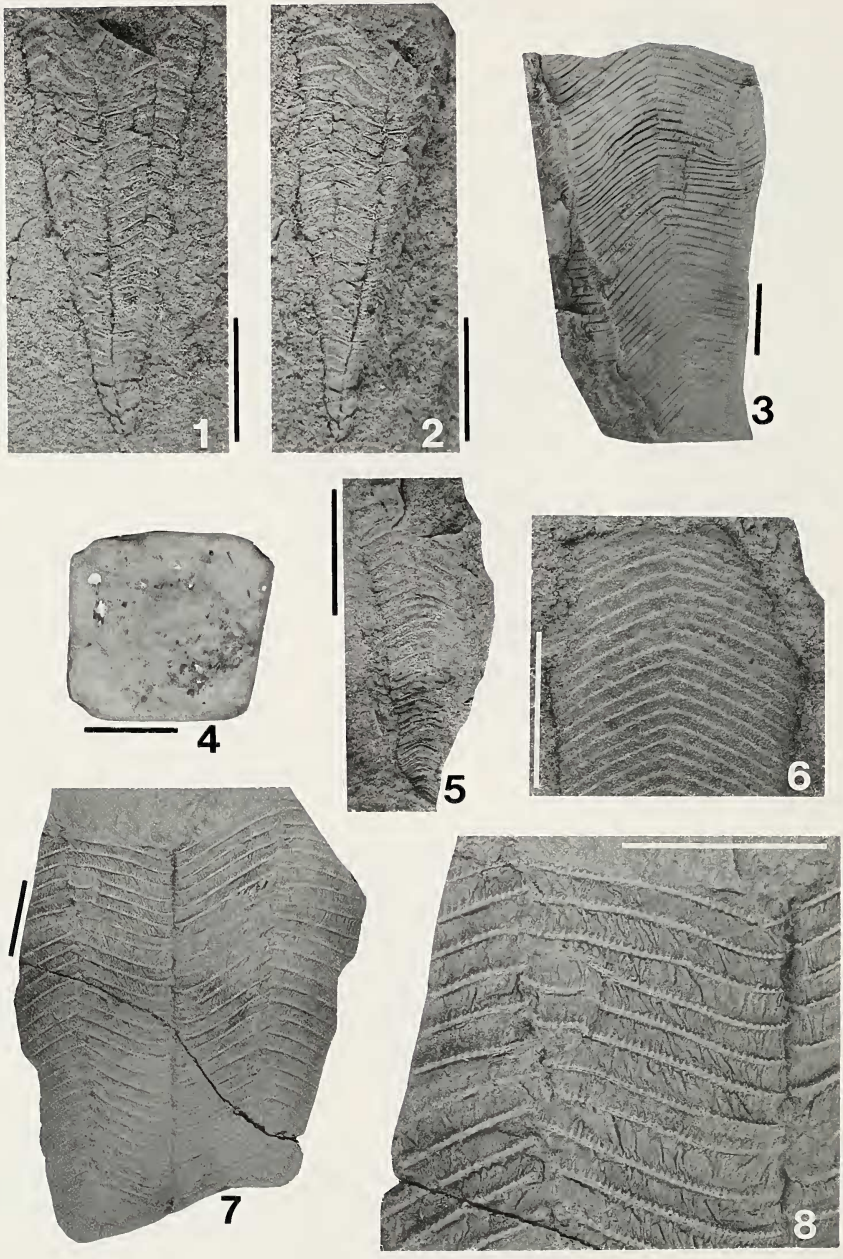
gray calcareous shale; locality 177. 32.3; *P. recurvatus* Babcock and Feldmann, n. sp., USNM 409806. Holotype to right; a paratype (USNM 409807) is indicated by arrow; locality 109. 32.4; *P. byblis* (White)?, UMMP 26735, a poorly preserved, collapsed specimen; locality 250. Original of Winchell (1871, p. 257). 32.5; *P. chesterensis* (Worthen)?, GSC 49383, a juvenile specimen with stalk preserved. Specimen not coated with ammonium chloride; locality 7. 32.6; *P. recurvatus* Babcock and Feldmann, n.sp., USNM 409806, same specimen as in Fig. 32.3, detail of holotype. Bar scales represent 1 cm.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skeleton a somewhat reticulate pattern. The genus is named for this characteristic.

At present, three species of conulariids are referred with certainty to *Reticulaconularia*: *C. penouili* from the Lower Devonian of Quebec, *C. sussexensis* Herpers from the Lower Devonian of New Jersey, and *C. baini* Ulrich from the Devonian of Bolivia. This third species occurs outside the geographic limits of this paper; we and others will redescribe the taxon in a paper on the Devonian conulariids of Bolivia.

RETICULACONULARIA PENOUILI (Clarke, 1907)
Figs. 34.3–34.5; 35.3

Conularia penouili Clarke, 1907, p. 180–181, 2 figs.; Clarke, 1908, p. 144, Pl. 11, figs. 10–11.
Conularia gaspesia Sinclair, 1942, p. 158–160, fig.
Conularia s.l. *penouili* Clarke. Sinclair, 1948, p. 283.

Description.—Exoskeleton a curved pyramid, expanding slowly and non-uniformly from the apex. Exoskeleton up to 6.7 cm in length. Major apical angle approximately 59°; minor apical angle approximately 22–30°. Rod articulation of inflected circular curve style in apical ⅓, angulated circular curve style in middle ⅓, and inflected circular curve style in apertural ⅓. Rods usually alternate at midline; if they alternate, pattern is usually left superior on both major and minor faces; rod angle 0–8°. 12–21 rods/cm. 1–2 nodes/mm. 1–2 adapertural spines/cm; adapical spines probably not present. Interridge furrows broadly rounded into longitudinally oblong pits. Apical wall not observed.

Occurrence.—Lower Devonian of Quebec; localities 228 and 246.

Types.—Holotype, NYSM 9412; topotype of *Conularia gaspesia,* GSC 87242.

Remarks.—*Reticulaconularia penouili* (Clarke) is distinguished from *R. sussexensis* (Herpers) by the following features. First, *R. penouili* has 12–21 rods/cm and *R. sussexensis* has 11–14 rods/cm. Greater rod spacing in *R. penouili,* combined with wide spacing between the nodes and between the adapical spines has produced large, oblong, hollowed

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Fig. 33.—33.1–33.2, *Paraconularia yochelsoni* Babcock and Feldmann, n. sp. 33.1; UMMP 45499, holotype; corner view; locality 93. 33.2; UMMP 45499, same specimen as in Fig. 33.1, major face. 33.3; *P. wellsvillia* Babcock and Feldmann, n. sp., CM 34502, paratype, preserved in siltstone; ?minor face; locality 161. 33.4; *P. subulata* (Hall), KSU 1172, cross section showing weakly bilateral, four-sided nature of the exoskeleton. Specimen not coated with ammonium chloride; locality 216. 33.5; *P. yochelsoni* Babcock and Feldmann, n. sp, UMMP 45500, paratype; locality 93. 33.6–33.8; *P. wellsvillia* Babcock and Feldmann, n. sp. 33.6; CM 34503, detail of paratype preserved as an internal mold in siltstone and not exhibiting interrod ridges or interrod furrows; locality 162. 33.7; CM 35001, holotype, a collapsed specimen preserved in silty shale; locality 161. 33.8; CM 35001, same specimen as in Fig. 33.7, detail of a minor face. Bar scales represent 1 cm.

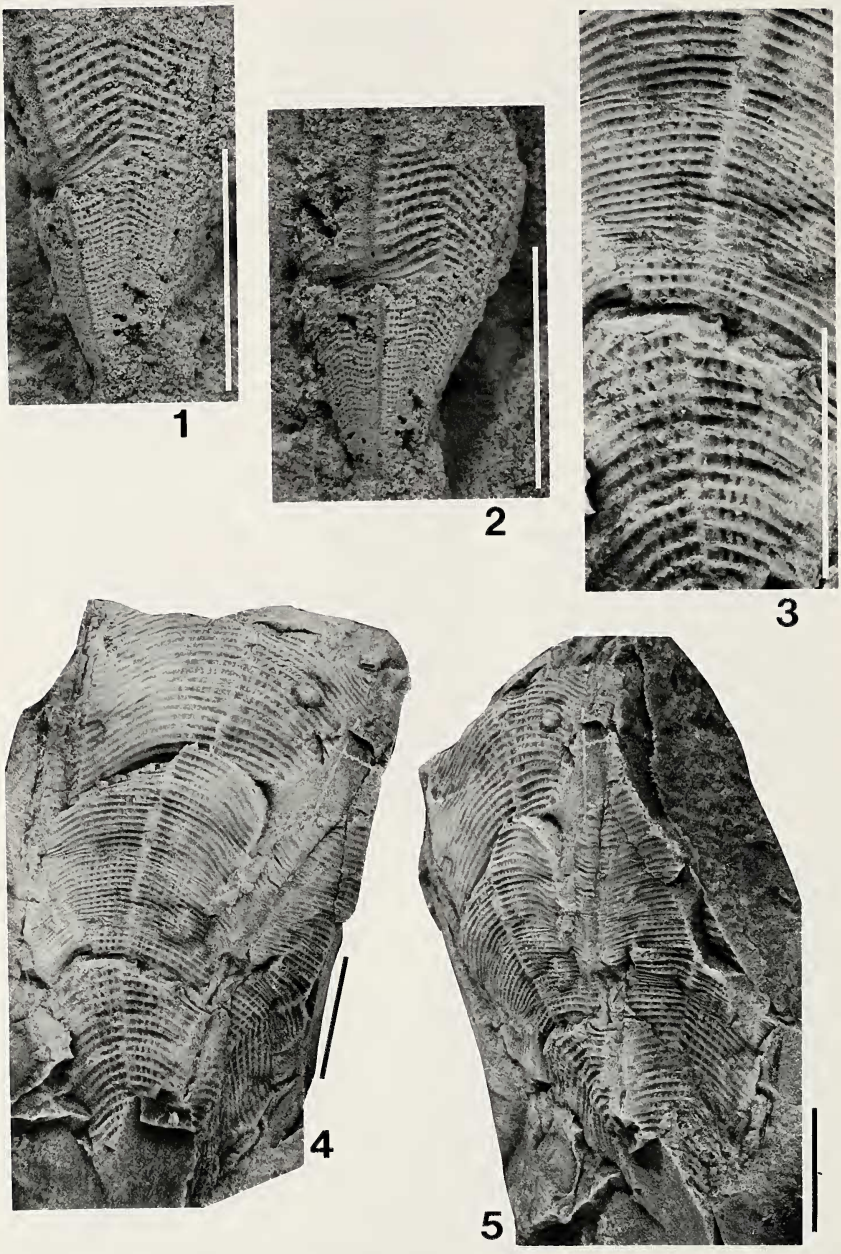

Fig. 34.—34.1–34.2; *Reticulaconularia sussexensis* (Herpers). 34.1; NJSM 10806, smaller of two specimens, major face of small specimen preserved in somewhat metamorphosed

out interridge furrows on the exterior surface of the exoskeleton. This feature is not exhibited, to this extent, on any other known species of conulariid.

Secondly, the values obtained for rod angles are consistently smaller for *R. penouili* than they are for *R. sussexensis,* 0–8° compared to 11–14°. *Reticulaconularia sussexensis* exhibits a greater number of rods which abut at the midline than does *R. penouili.* Up to 70% of rods abut in specimens of *R. sussexensis* while 20–30% of rods abut in the holotype of *R. penouili.* Unlike *R. sussexensis, R. penouili* shows an alternation between a circular curve style of rod articulation and an angulated circular curve style. *Reticulaconularia sussexensis* exhibits only an inflected gothic arch style of rod articulation. Finally, judging from the available sample, specimens of *R. sussexensis* seem to have a smaller maximum length than *R. penouili.* The maximum recorded hypothetical length of a specimen of *R. sussexensis* is about 2.5 cm. The hypothetical length of the holotype of *R. penouili* is 6.7 cm.

The holotype of *Conularia gaspesia* Sinclair, which was said to have been deposited in the RM(MU) (Sinclair, 1942, p. 160) apparently never was deposited in that museum (Ingrid Birker, written communication, 1985), and is now presumed to be lost. However, we have found, in the Sinclair collection housed in the GSC, a specimen labelled as *C. gaspesia* (GSC 87242; Fig. 35.3). The handwriting on a label accompanying the specimen is unmistakably that of G. Winston Sinclair. This specimen is of further value because a label glued to the specimen indicates that it was collected from Lower Devonian Grande Grève Limestone on the Gaspé Peninsula; thus, the specimen is a topotype.

This topotype specimen of *C. gaspesia,* GSC 87242, exhibits one well preserved face and has all of the salient morphological characteristics that the holotype of *R. penouili* posseses. Among the characteristics shown by the topotype of *C. gaspesia* are large, oblong, hollowed out interridge furrows, just as are present in the holotype of *R. penouili.* A good photograph of the holotype of *C. gaspesia* (Sinclair, 1940, fig.) shows these same features. Measurements taken on the topotype specimen are given in Appendix B. The only way in which GSC 87242 differs from the holotype of *R. penouili,* NYSM 9412, is that it is not

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siltstone; locality 112. 34.2; NJSM 10806, same specimen as in Fig. 34.1, corner view. Note prominent exoskeletal constriction. 34.3–34.5; *R. penouili* (Clarke). 34.3; NYSM 9412, holotype, detail of minor face; locality 246. 34.4; NYSM 9412, same specimen as in Fig. 34.3, minor face of specimen preserved in micrite. 34.5; NYSM 9412, same specimen as in Fig. 34.3, major face. Bar scales represent 1 cm.

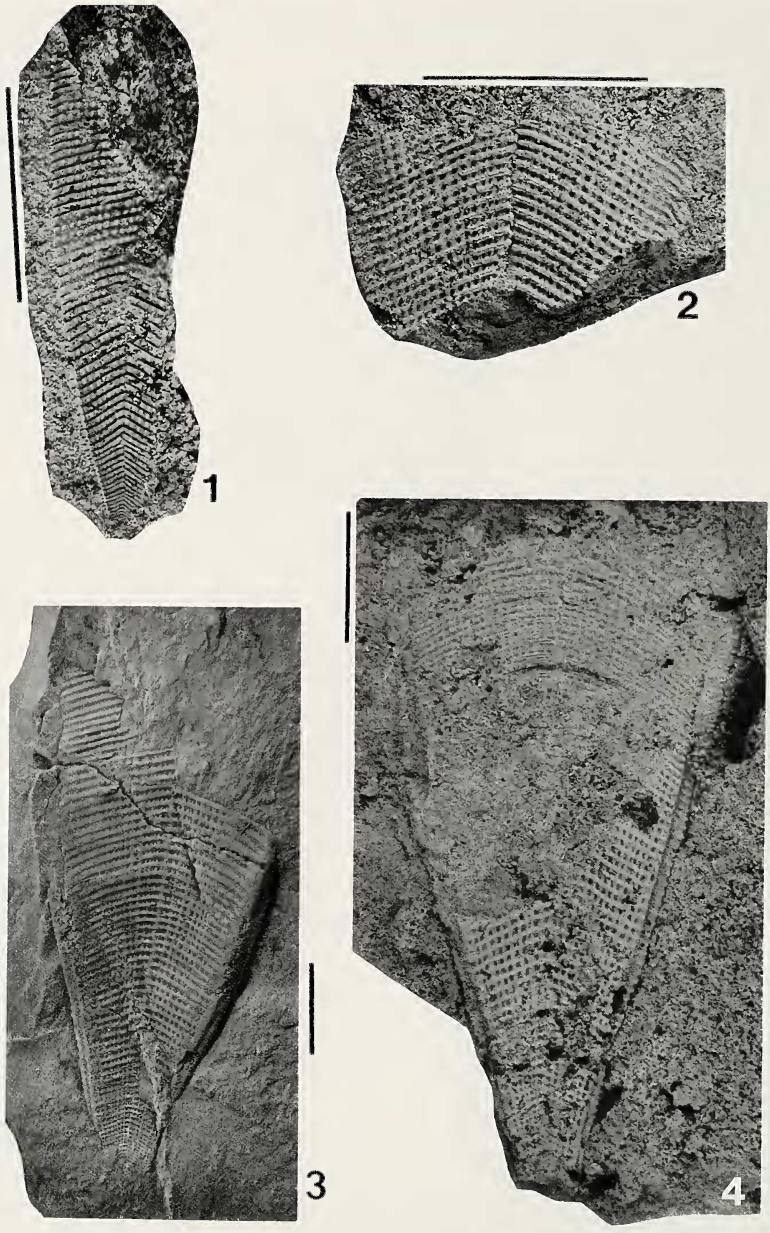

Fig. 35.—35.1–35.2. *Reticulaconularia sussexensis* (Herpers). 35.1; NJSM 10750, external mold of apical region of very small paratype specimen; locality 112. 35.2; NJSM 10751, largest of three specimens, paratype, preserved as an external mold; locality 112. 35.3; *R. penouili* (Clarke), GSC 87242, ?minor face of topotype of *Conularia gaspesia*

curved in the apical region. However, NYSM is a somewhat crushed or collapsed individual. One final interesting point is that both NYSM 9412 and GSC unassigned were collected from the Grande Grève Limestone on the Gaspé Peninsula. Based upon this topotype specimen of *C. gaspesia,* this taxon is here placed in synonymy with *R. penouili.*

Material examined.—2 specimens; housed in the GSC and the NYSM.

RETICULACONULARIA SUSSEXENSIS (Herpers, 1949)
Figs. 34.1–34.2, 35.1–35.2, 35.4

Conularia sussexensis Herpers, 1949, p. 1–7, Pl. 1, 2.
Conularia gaspesia Sinclair. *Sensu* Herpers, 1950, p. 619.

Description.—Exoskeleton up to 2.5 cm in length. Major apical angle 24–28°; minor apical angle 22–25°. Rod articulation uniformly of inflected gothic arch style. Rods usually abut at midline; if they alternate, they usually occur left superior on major face and right superior on minor face; rod angle 11–14°. Approximately 39 rods/cm (extrapolated) in apical region; 14–18 rods/cm elsewhere. 2 nodes/mm; 2 adapertural rods/mm; adapical spines absent. Apical wall not observed.

Types.—Holotype, NJSM 10749; four paratypes, NJSM 10750, NJSM 10751 (three specimens).

Occurrences.—Lower Devonian of New Jersey; localities 111, 112, 113.

Remarks.—The present samples of *R. sussexensis* (Herpers) differ from the holotype of *R. penouili* (Clarke) in that the former: 1, is of smaller size; 2, has no curvature to the exoskeleton; 3, has smaller apical angles, especially on the major face; 4, has a greater number of rods/cm; 5, has larger rod angles; 6, shows greater than 30% of the rods abutting at the midline; and 7, shows only an inflected gothic arch style of rod articulation. These differences are discussed more fully in the remarks accompanying the description of *R. penouili,* above.

Material examined.—10 specimens; housed in the NJSM.

ORGANISMS PREVIOUSLY ASSIGNED TO CONULARIIDA, HERE REJECTED FROM THE PHYLUM

Phylum Mollusca
Class Hyolitha
HYOLITHES sp.
Fig. 17.4

Conularia sp. Ellison, 1965, p. 48–49, Pl. 4, fig. 1.
Hyolithes sp. Babcock, 1985*b*, p. 14–16, fig. 1.

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Sinclair, preserved in micritic limestone; locality 242. 35.4; *R. sussexensis* (Herpers), NJSM 10749, ?major face of holotype, preserved in somewhat metamorphosed siltstone; locality 112. Bar scales represent 1 cm.

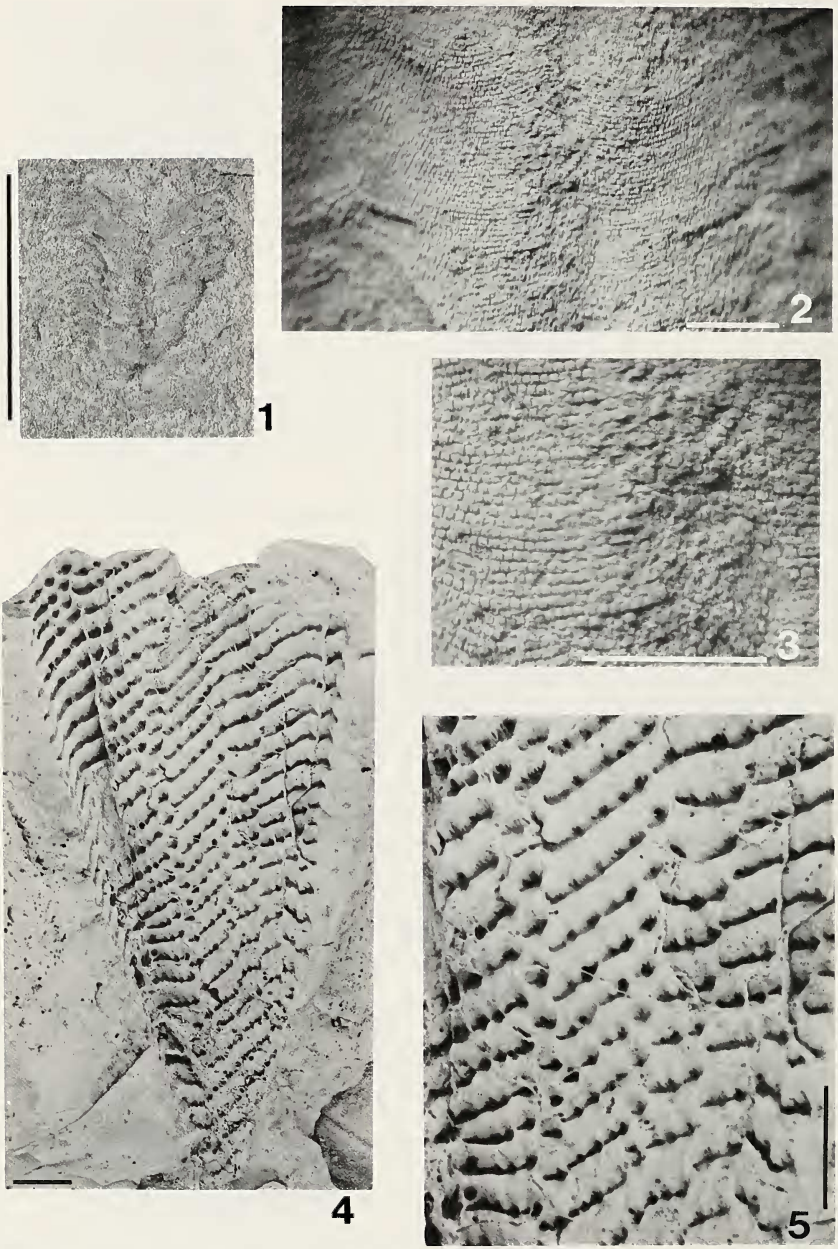

Fig. 36.—36.1–36.3; "*Conularia*" *tenuicostata* Branson, here interpreted to be a ?priapulid worm. 36.1; UMC 4271, holotype; locality 99. 36.2; UMC 4271, detail of same

Occurrence.—Middle Devonian of Pennsylvania; locality 240.

Figured specimen.—USNM 173928.

Remarks.—Ellison's figured specimen (1965, plate 4, fig. 1) is a small conical shell expanding slowly and uniformly from a bluntly rounded apex. The specimen possesses thin, closely spaced, raised lines, concentric about the apex. Crushing has produced a long, irregular line down the middle of the shell. A ligula, or an apertural extension of the shell on the dorsal side, is present, clearly indicating that the specimen is a hyolith, not a conulariid.

Phylum Priapulida?
Figs. 36.1–36.3

Conularia tenuicostata Branson, 1938, p. 111, Pl. 14, figs. 5–6; Branson, 1944, p. 216.
Mesoconularia tenuicostata (Branson). Sinclair, 1948, p. 128.

Occurrence.—Lower Mississippian of Missouri; locality 99.

Type.—Holotype, UMC 4271.

Remarks.—The holotype, and only known specimen of *Conularia tenuicostata* Branson, possesses tiny nodes or pustules arranged in closely spaced rows which appear to run essentially perpendicular to the long axis of the fossil. The rows of nodes or pustules are not supported by calcium phosphate rods. Additionally, the specimen is flattened and micrite replaced. This type of preservation is unlike that expected of an animal composed of calcium phosphate, such as a conulariid. Rather, the preservation is similar in appearance to the preservation of objects having a tough cuticle, such as *Plectodiscus discoideus* (Rauff), a chondrophorine cnidarian from the Hunsrück Slate (Devonian) of West Germany (Yochelson et al., 1983).

Branson's specimen possesses indiscrete ringlike segments delimited by thin, latitudinally arranged crests 0.5 to 0.7 mm apart. These segments are each covered with closely spaced, latitudinally arranged rows of minute papillae which are strikingly similar to the cuticle of living priapulid worms such as *Priapulus* and *Tubiluchus*. However, there is not enough of the holotype preserved to determine whether the animal possessed spines, a common feature of living priapulids. Thus, this fossil is referred to the phylum Priapulida with reservation.

The specimen in question preserves only a small portion of cuticle,

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specimen as in Fig. 36.1, showing ridges delimiting annular segments. 36.3; detail of same specimen as in Fig. 36.1, showing surface structure. 36.4–36.5; *Oracanthus* sp. 36.4; USNM 409810; locality 6. 36.5; USNM 409810; detail of specimen in Fig. 36.5, interpreted to be remains of fish spine. Bar scales in Figs. 36.1 and 36.4–36.5 represent 1 cm; bar scales in Figs. 36.2 and 36.3 represent 1 mm.

7.5 mm long and 8.1 mm wide. It is broken at its upper and lower margins, presumably between adjacent segments. This mode of preservation supports the interpretation that the specimen possessed a multielement covering, capable of readily fragmenting or tearing.

Phylum Chordata
Class Vertebrata
Order Pisces
ORACANTHUS sp.
Figs. 36.4–36.5

Conularia newberryi Winchell? *Sensu* McKee and Gutschick *in* McKee and Gutschick, 1969, p. 125–172.

Occurrence.—Lower Mississippian of Arizona; locality 5.

Figured specimen.—External mold preserved in dolostone and latex mold, USNM 409810.

Remarks.—This figured specimen mimics a conulariid in having nodose structures arranged in rows, crossing the surface transversely. The rows, however, are discontinuous, and form chevron-shaped patterns in some places. The rows seem to be composed of semidiscrete pits arranged in side-by-side fashion. As the specimen is an external mold, the "pits" would correspond to nodes. These is no evidence on the specimen of either a midline or a corner groove. The specimen is undulated near the left margin, however.

This specimen is here regarded as the spine of a gyracanthid shark. Michael E. Williams, of the Cleveland Museum of Natural History, has viewed this specimen and has noted that small portions of dentine adhere to it in places, confirming that it is a vertebrate fossil. It is his suggestion that this specimen be referred to the genus *Oracanthus*.

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APPENDIX A—LOCALITY INDEX

Collector, year of collection if known, description of locality, stratigraphic assignment and conulariid taxa present

ALABAMA

1 A. S. Horowitz. "Keyes site," Skyline, Alabama. Formation unknown; probably Chesterian Series. *Paraconularia chesterensis.*

ALBERTA

2 Anonymous. Near Banff, Alberta. Formation unknown and series unknown; Mississippian Subsystem. *Paraconularia missouriensis*?

3 R. G. McConnell, 1890. Athabasca River, La Saline, Alberta. Formation unknown; Chautauquan Series. *Paraconularia salinensis.*

4 H. W. Shimer, pre-1926. Lake Minnewanka, Alberta. Formation and series unknown; Mississippian Subsystem. *Paraconularia alternistriata.*

5 F. Beales. Upper part of Job Creek, western Alberta. Upper Rundle Formation, 345 m from the base of the formation; Chesterian Series. *Paraconularia missouriensis*?

ARIZONA

6 R. C. Gutschick and P.C.H., 1954. Top of mesa on point between Rock and Blye Canyons on 7BarV Ranch, WF Cattle Company, south of Peach Springs and Cherokee Point, Arizona. Chert in Member 2 of Redwall Limestone, about 53 m above base of Redwall Formation; ?Osagean Series. No conulariids collected; *Oracanthus* spine.

BRITISH COLUMBIA

7 D. Scott, 1962. Spur on northeast corner of Mt Hosmer, 14.5 km northeast of Fernee and 14.5 km southwest of Natal, British Columbia. Lower Etherington Member of the Rocky Mountain Formation of the Rundell Group; Chesterian Series. *Paraconularia chesterensis*?

ILLINOIS

8 Anonymous. Kinderhook, Pike County, Illinois. Kinderhook Group; Kinderhookian Series. *Conularia subcarbonaria.*

9 W. F. E. Gurley; Anonymous. Hamilton, Illinois. Keokuk Limestone; Osagean Series. *Conularia subcarbonaria.*

10 Anonymous. Chester, Randolph County, Illinois. Chester Limestone; Chesterian Series. *Paraconularia chesterensis.*
11 Sloss. Pike County, Illinois. Burlington Limestone; Osagean Series. *Paraconularia chesterensis, P. blairi.*
12 S. Weller, 1912. About 2.4 km south of Marigold, Illinois. "Lower Okaw, Marigold Oolite" (=Burlington Limestone?); Osagean Series. *Paraconularia chesterensis.*
13 W. F. E. Gurley; Anonymous. Hamilton, Illinois. Keokuk Limestone; Osagean Series. *Conularia subcarbonaria.*
14 W. F. E. Gurley. Madison County, Illinois. St. Louis Limestone; Meramecian series. *Paraconularia missouriensis.*
15 Anonymous. Warsaw, Madison County, Illinois. St. Louis Limestone; Meramecian Series. *Paraconularia missouriensis.*
16 Anonymous. Alton, Illinois. St. Louis Formation; Meramecian Series. *Paraconularia subulata, P. chesterensis.*
17 W. F. Gurley. Madison County, Illinois. St. Louis Limestone; Meramecian Series. *Paraconularia chesterensis.*
18 S. Weller, 1912. About 3.2 km east of Waterloo, Illinois, Illinois. Renault Limestone; Chesterian Series. *Paraconularia chesterensis.*
19 S. Weller, 1918. About 4 km southeast of Vienna, Illinois. Glen Dean Limestone; Chesterian Series. *Paraconularia chesterensis.*
20 A. S. Horowitz, 1966. Debris from slope below quarry in Mississippi River bluffs above Illinois State Highway 3 Bypass, SW¼, SW¼ Sec.29, T7S, R6W, Chester, Randolph County, Illinois, Chester 7.5′ Quadrangle. Menard Limestone; Chesterian Series. *Paraconularia chesterensis, Conularia* cf. *C. subcarbonaria.*
21 L. F. Rauchfrise; Anonymous. Pope County, Illinois. Chester Group; Chesterian Series. *Paraconularia chesterensis.*

INDIANA

22 E. M. Kindle. Delphi, Indiana. Sellersburg Formation; Chautauquan Series. *Conularia delphiensis.*
23 D. G. Maroney and R. W. Orr, pre-1974. Delphi Limestone Company Quarry, north side of U.S. Highway 421, northwest edge of Delphi, SW¼, SW¼ Sec. 19, T25N R2W, Carroll County, Indiana, Delphi 7.5′ Quadrangle. 0–10 cm thick phosphatic pebble bed at base of New Albany Shale; Chautauquan Series. *Conularia delphiensis.*
24 D. E. Hattin? Probably Indiana. Probably Harrodsburg Formation; Osagean Series. *Conularia subcarbonaria.*
25 D. E. Hattin. Hattin location S-776. Indiana. Borden Group; Meramecian Series. *Conularia multicostata.*
26 Anonymous. Curiosity Hollow, near Martinsville, Indiana. New Providence Formation; Osagean Series. *Paraconularia* cf. *P. subulata.*
27 Anonymous. Crawfordsville, Indiana. "Keokuk Group" (=Borden Group); Osagean Series. *Conularia subcarbonaria, Paraconularia chesterensis.*
28 W. F. E. Gurley. West Point, Indiana. "Keokuk Group" (=Borden Group); Osagean Series. *Conularia subcarbonaria.*
29 G. K. Greene; Washburn. New Albany, Indiana. "Knobstone Group" (=Borden Group); Osagean Series. *Paraconularia byblis, P. subulata.*
30 Anonymous. Spergen Hill, Indiana. St. Louis Limestone; Meramecian Series. *Paraconularia missouriensis.*
31 W. F. Gurley; Anonymous. Edwardsville, Indiana. "Keokuk Group" (=Borden Formation); Osagean Series. *Paraconularia missouriensis.*
32 Klippart. New Providence, Indiana. Carwood Member, Borden Formation; Osagean Series. *Paraconularia blairi.*

33 E. O. Ulrich. Crawfordsville, Indiana. Borden Formation ("Keokuk Group"); Osagean Series. *Paraconularia chesterensis.*
34 Anonymous. Near Providence, Indiana. Borden Formation; Osagean Series. *Paraconularia blairi.*
35 C. Rominger? Crawfordsville, Montgomery County, Indiana. Near middle of Borden Group; Osagean Series. *Paraconularia chesterensis.*
36 S. Makvrat. Bed of Gnaw Bone Creek just south of Indiana Highway 46, just east of Gnaw Bone, Indiana, Nashville 7.5′ Quadrangle. New Providence Shale according to collector; more likely Carwood or Locust Point Formation of Borden Group according to A. S. Horowitz (written communication, 1984); ?Osagean Series. *Paraconularia* cf. *P. byblis, P. chesterensis.*
37 R. Fields and J. Harris, 1981. Section on old Indiana Highway 37, SE¼, NW¼, NW¼ Sec.21, T9N, R1W, Monroe County, Indiana, Bloomington 7.5′ Quadrangle. Ramp Creek Member of Harrodsburg Limestone, 3–7 m above contact with Borden Group; ?Osagean Series. *Conularia subcarbonaria.*
38 J. Hall?; Washburn; Anonymous. Crawfordsville, Indiana. "Keokuk Group" (=Borden Group); Osagean Series. *Conularia subcarbonaria, Paraconularia chesterensis, P. subulata.*
39 W. F. E. Gurley; G. Robb, pre-1923. New Albany, Indiana. "Knob or Knobstone Shale" (=Borden Group?); Osagean Series. *Conularia multicostata, Paraconularia byblis, P. chesterensis, P. missouriensis, P. subulata.*
40 W. F. E. Gurley. West Point, Indiana. "Keokuk Group (=Borden Formation)"; Osagean Series. *Paraconularia chesterensis.*
41 R. L. Anstey et al., 1968. Bed of Indian Creek on O. C. Bennett or Ben Wilson property, approximately .8 km north of Indiana Highway 234, NE¼, NW ¼, SE¼ Sec. 8, T17N, R5W, Montgomery County, Indiana. ?Edwardsville Formation of Borden Group; Osagean Series. *Paraconularia* cf. *P. chesterensis.*
42 C. Rominger? Crawfordsville, Montgomery County, Indiana. Near middle of Borden Group; Osagean Series. *Conularia subcarbonaria.*
43 G. Campbell. Floyds Knob Hill, Highway 150, near center of NE¼ 28-25-6E (*sic*), 3.2 km northwest of New Albany, Indiana. Kenwood Formation; ?Osagean Series. *Paraconularia byblis.*
44 W. F. E. Gurley. Spergen Hill, Indiana. Probably St. Louis Limestone, though possibly Salem Limestone; Meramecian Series. *Conularia subcarbonaria.*
45 W. F. E. Gurley. Spergen Hill, Indiana. St. Louis Limestone or Salem Limestone; Meramecian Series. *Conularia subcarbonaria.*
46 Anonymous. Salem, Indiana. Salem Limestone; Meramecian Series. *Conularia subcarbonaria.*
47 A. S. Horowitz, N. G. Lane et al. Outcrop along west branch of Mosquito Creek, 0.48 km west and 0.24 km north of southeast corner of Sec. 25, T5S, R5E, approximately 4.5 km east of Laconia, Harrison County, Indiana; Laconia 7.5′ Quadrangle. Somerset Shale; Chesterian Series. *Paraconularia chesterensis.*
48 J. J. Galloway, 1949. Galloway location 1.40C, ravine beginning at railroad, 1.2 km northwest of Harrodsburg and running northwest 0.8 km to old Indiana Highway 7, SE¼, SW¼ Sec. 20, T7N R1W, Monroe County, Indiana, Clear Creek 7.5′ Quadrangle. Lower part of Harrodsburg Formation; Meramecian Series. *Conularia* cf. *C. subcarbonaria.*
49 J. J. Galloway, 1949. Galloway location 1.70A, old quarry, 4 km northwest of Dolan, Monroe County, Indiana. Site is probably an abandoned Quarry 2.4 km northwest of Dolan shown on Modesto 7.5′ Quadrangle topographic map; W½, SW¼, NW¼ Sec. 34, T10N R1W, approximately 0.4 km east of old Indiana Highway 37 (A.S. Horowitz, written communication, 1984). Lower part of Harrodsburg Formation; Meramecian Series. *Paraconularia chesterensis.*
50 D. E. Hattin, 1965. Roadcut on State Highway 46, east of Gnaw Bone, approxi-

mately N½, N½ Sec.25, T9N, R4E, Brown County, Indiana, Nashville 7.5′ Quadrangle. Carwood Formation of Borden Group; Chesterian Series. *Paraconularia* cf. *P. byblis, P. chesterensis.*

51 Anonymous. Spergen Hill, Indiana. Spergen Limestone; Meramecian Series. *Conularia subcarbonaria, Paraconularia chesterensis.*

52 Anonymous. Spergen Hill, Indiana? Spergen Hill Limestone?; Meramecian Series? *Paraconularia chesterensis.*

53 Anonymous. Hendricks County, Indiana. Formation unknown; probably Chesterian Series. *Paraconularia chesterensis.*

54 W. F. E. Gurley. Evansville, Indiana. "Chester Group"; Chesterian Series. *Paraconularia chesterensis.*

55 A. S. Brockley and T. G. Perry, 1954. Debris from Mulzer Brothers Quarry, SW¼, NE¼ Sec. 3, T2S, R2W, Crawford County, Indiana, Taswell 7.5′ Quadrangle. "Glen Dean Limestone" (=Lower Tar Springs Formation); Chesterian Series. *Paraconularia chesterensis.*

56 A. S. Horowitz. Spoil heaps from Mulzer Brother Quarry, north and south of county road, approximately 1.5 km south of junction of Indiana Highways 145 and 164 and approximately 4 km north of Eckerty and .4 km east of Indiana Highway 145, SW¼, SE¼ Sec. 10, T2S, R2W, Crawford County, Indiana, Taswell 7.5′ Quadrangle. Glen Dean Limestone; Chesterian Series. *Paraconularia chesterensis.*

57 A. S. Horowitz et al., 1956–1982. Railroad cuts on west side of Baltimore and Ohio Railroad spur leading to National Gypsum Company quarry, near Shoals, SW¼, NE¼ Sec. 28, T3N R3W, Martin County, Indiana, Huron 7.5′ Quadrangle. "Golconda Formation" (=Indian Springs Member of the Big Clifty Formation); Chesterian Series. *Paraconularia chesterensis.*

58 A. C. Brookley and T. G. Perry, 1954. Debris from abandoned Lutgring Quarry, 9.6 km east of Branchville, NW¼, SW¼ Sec.18, T1S, R1W, Perry County, Indiana, Branchville 7.5′ Quadrangle. "Glen Dean Limestone" (=Lower Tar Springs Formation); Chesterian Series. *Paraconularia chesterensis.*

59 Haines. Washington County, Indiana. Formation unknown; probably Chesterian Series. *Paraconularia chesterensis.*

60 J. Below, 1965. Dam site 4.8–6.4 km north off Route 46, 4.8 km east of Gnaw Bone, Indiana. Borden Group; Osagian Series? *Paraconularia byblis.*

Iowa

61 W. F. Gurley. Le Grand, Iowa. Formation unknown; Kinderhookian Series. *Conularia subcarbonaria, Paraconularia blairi.*

62 C. A. White? Burlington, Iowa. English River Sandstone of the Kinderhook Group; Kinderhookian Series. *Paraconularia byblis.*

63 C. A. White? Burlington, Iowa. "Upper Division of the Burlington Limestone"; probably Osagian Series. *Paraconularia subulata.*

64 Anonymous. Iowa City, Iowa. Cedar Valley Limestone; Chautauquan Series. *Conularia subcarbonaria.*

65 Anonymous. Probably Iowa City area, Iowa. Probably Cedar Valley Limestone; Chautauquan Series. *Conularia subcarbonaria.*

66 Anonymous. Burlington, Iowa. Burlington Limestone; Osagean Series. *Paraconularia byblis.*

67 Fenton. Southwest of Waverly, Iowa. Cedar Valley Limestone, lower part; Osagean Series. *Conularia subcarbonaria.*

68 Anonymous. Burlington, Iowa. Burlington Limestone; Osagean Series. *Conularia subcarbonaria.*

69 Anonymous. Keokuk, Iowa. Keokuk Formation; Osagean Series. *Paraconularia missouriensis.*
70 S. Weller? Keokuk, Iowa. Keokuk Limestone, "bed 11"; Osagean Series. *Paraconularia chesterensis.*

KENTUCKY

71 C. E. Mason, 1984. Outcrops along Interstate 64, 8.2 km east of the junction with Kentucky Route 32, near Morehead, Rowan County, Kentucky. Float from lower few meters of Nancy Member of Borden Formation; Osagean Series. *Conularia multicostata, Paraconularia byblis.*
72 C. E. Mason, T. M. Stanley, and L. E. Babcock, 1984. Nancy Member of Borden Formation; phosphate pebble bed about 1 m above top of "dysaerobic fauna"; Osagean Series. Spillway to Cave Run Lake, Daniel Boone National Forest, Bath County, Kentucky, Salt Lake 7.5′ Quadrangle. *Conularia multicostata, Paraconularia byblis, P. subulata.*
73 Anonymous. Natural Bridge, Kentucky. Borden Formation, probably Nancy Member (*fide* F. R. Ettensohn, written communication, 1985); Osagean Series. *Conularia multicostata.*
74 Anonymous. Marion County, Kentucky. Borden Formation?; Osagean Series? *Paraconularia byblis.*
75 Anonymous. Lebanon, Kentucky. "Waverly Formation" (=Borden Group?); probably Osagean Series. *Paraconularia subulata.*
76 Anonymous. About 2.5 km east of Lebanon, Kentucky. New Providence Formation; Osagean Series. *Conularia subcarbonaria, Paraconularia byblis.*
77 T. W. Kammer. Kammer location 10885, St. Francis, Kentucky. Nancy Member of the Borden Formation; Osagean Series. *Paraconularia byblis.*
78 T. W. Kammer. Kenwood Hill, Louisville, Kentucky. New Providence Shale Member of the Borden Formation; Osagean Series. *Paraconularia byblis.*
79 Anonymous. Kentucky? Waverly Group equivalent?; Osagean Series? *Conularia multicostata.*
80 U. P. James. Boyle or Marion County, Kentucky. "Waverly Group" (=Borden Group?); probably Osagean Series. *Conularia multicostata.*
81 Anonymous. Knob just south of Louisville, Kentucky. New Providence Formation; ?Osagean Series. *Paraconularia byblis.*
82 G. Robb, pre-1923. Marion County, Kentucky. "Keokuk Formation, Knob Shale" (=Borden Formation?); Osagean Series. *Paraconularia subulata.*
83 Anonymous. Elizabethtown, Kentucky. St. Louis Limestone; Meramecian Series. *Paraconularia missouriensis.*
84 A. S. Horowitz. Pond north of Kentucky Highway 1576, about 2 miles east of Morrilla, Jackson County, Kentucky. Pennington Formation; Chesterian Series. *Paraconularia chesterensis.*
85 A. S. Horowitz. Near Colesburg, Hardin County, Kentucky. Somerset Shale Member of Salem Limestone; Meramecian Series. *Paraconularia chesterensis.*
86 S. Weller, 1920. 5.2 km south of Iola, Kentucky (GK 12). Glen Dean Limestone; Chesterian Series. *Paraconularia chesterensis.*
87 Anonymous. About 1.5 km west of Mongomery Switch, Caldwell County, Kentucky. Claystone bed of upper Chester Formation; Chesterian Series. *Paraconularia chesterensis.*
88 A. S. Horowitz, 1966, etc. Pond above road leading to Pearson Farm glade (road not on topographic map), near junction of road with Kentucky Highway 1576, approximately 3.0 km east of junction of Kentucky Highway 1576 and U.S. Highway

421, approximately 3 km east of Morrill, Jackson County, Kentucky, Big Hill 7.5′ Quadrangle. Lower part of Pennington Formation, just above top of Bangor Limestone; Chesterian Series. *Paraconularia chesterensis.*

89 A. S. Horowitz, 1969. Roy Norton Farm, glades on north, west and south slopes of tributaries on north side of Broad Run, 50–100 m south of Kentucky Highway 434, approximately 2.6 km west-southwest of Colesburg, Hardin County, Kentucky, Colesburg 7.5′ Quadrangle. Somerset Shale Member of the Salem Limestone; Chesterian Series. *Paraconularia chesterensis.*

MAINE

90 Anonymous. Presque Isle stream, Chapman Plantation, Maine. Chapman Sandstone; series unknown, Devonian System. *Conularia* cf. *C. undulata.*

MARYLAND

91 F. M. Swartz. West Maryland Railroad tracks, Corrigansville, Maryland. Upper part of the Shriver Chert; Ulsterian Series. *Conularia undulata.*

MICHIGAN

92 Anonymous. Alpena, Michigan. Alpena Limestone; Erian Series. *Paraconularia alpenensis.*

93 E. W. Hard. U.S. Gypsum Company Quarry, Sec. 27, T27N, R7E, near Alabaster, Michigan. Michigan Formation, gray gypsiferous limestone bed 1.3 m below 5.3 m thick bed of mottled white gypsum; Osagean Series. *Paraconularia yochelsoni.*

MISSOURI

94 Sampson; Faber. Sedalia, Missouri. Chouteau Limestone; Kinderhookian Series. *Paraconularia blairi, P. missouriensis.*

95 J. S. Williams, 1930? Easley, Missouri. Chouteau Limestone; Kinderhookian Series. *Paraconularia blairi.*

96 E. B. Branson. Providence, Missouri. Chouteau Limestone; Kinderhookian Series. *Paraconularia blairi.*

97 E. B. Branson, 1930. Providence, Missouri. Couteau Limestone; Kinderhookian Series. *Paraconularia blairi.*

98 Anonymous. Pettis County, Missouri. Chouteau Limestone; Kinderhookian Series. *Paraconularia blairi.*

99 E. B. Branson. Browns, Missouri. Chouteau Limestone; Kinderhookian Series. No conulariids identified; ?priapulid worm, "*Conularia*" *tenuicostata.*

100 W. F. E. Gurley. Boonville, Missouri. Keokuk Limestone; Osagean Series. *Paraconularia missouriensis.*

101 Anonymous. Carthage, Missouri. Formation unknown; Meramecian Series. *Conularia subcarbonaria.*

102 Van Horne. Foot of La Beaume Street, St. Louis, Missouri. St. Louis Limestone; Meramecian Series. *Paraconularia blairi, P. chesterensis.*

103 Anonymous. Kansas City, Missouri. "Coal Measures"; probably Osagean or Meramecian Series. *Paraconularia missouriensis.*

104 Anonymous. Carthage, Missouri. Keokuk Limestone; Osagean-Meramecian Series. *Paraconularia chesterensis.*

105 Anonymous. Little Rock, St. Genevieve County, Missouri. St. Louis Limestone; Meramecian Series. *Paraconularia blairi.*

MONTANA

106 R. Lund et al., 1978–1984. Potter's Creek Dome, approximately 50 km southeast of Lewistown, Fergus County, Montana. Bear Gulch Limestone of Heath Formation; Chesterian Series. *Paraconularia subulata.*

107 W. H. Easton? Delpine, Meagher County, Montana. Cameron Creek Shale of the Big Snowy Group; Chesterian Series. *Paraconularia subulata.*

NEVADA

108 Merriam. Simpson Park Range, Nevada. Rabbit Hill Limestone; Ulsterian Series. *Conularia* sp.

109 A. J. Boucot, 1984. West face of Red Hill, Eureka County, Nevada. "Fish bed" of the Denay Limestone; Senecan Series. *Conularia recurvatus.*

110 C. D. Walcott. Eureka District, Nevada. Formation and series unknown; probably Chesterian Series. *Paraconularia chesterensis.*

NEW JERSEY

111 D. Parris and K. Cruikshank, 1980. On Weider Road, near County Road 521, Montague Township, Sussex County, New Jersey. Esopus Formation; Ulsterian Series. *Reticulaconularia sussexensis.*

112 H. Herpers. Montague, Sussex County, New Jersey. Esopus Formation; Ulsterian Series. *Reticulaconularia sussexensis.*

113 H. Herpers, 1948. Millville, Montague Township, Sussex County, New Jersey. Esopus Formation; Ulsterian Series. *Reticulaconularia sussexensis.*

114 D. Parris, K. Cruikshank et al., 1984. 1.7 km southwest of Wallpack Centre, roadcut across from Batteli's Campground, Wallpack Township, Sussex County, New Jersey. Port Ewen Formation; Ulsterian Series. *Conularia pyramidalis.*

NEW YORK

115 R. M. Fulle. First Esopus outcrop south-southeast of Hurley, on left fork of road, about 1.6 km from Hurley, Ulster County, New York. Esopus Formation; Ulsterian Series. *Conularia ulsterensis.*

116 Anonymous. Schoharie, New York. New Scotland Limestone; Ulsterian Series. *Conularia pyramidalis.*

117 Anonymous. Clarkesville, Schoharie County, New York. "Lower Helderberg Group" (=New Scotland Limestone); Ulsterian Series. *Conularia pyramidalis.*

118 Anonymous. Probably Clarksville area, Schoharie County, New York. Helderberg Group?, possibly New Scotland Limestone; Ulsterian Series. *Conularia pyramidalis.*

119 Anonymous. NYSM locality 2969, near Helderberg, New York. Manlius Limestone; Ulsterian Series. *Conularia pyramidalis.*

120 Anonymous. Countryman's Hill, New Salem, New York. Coeymans Limestone or New Scotland Limestone; Ulsterian Series. *Conularia pyramidalis.*

121 Anonymous. Knox, Albany County, New York. Oriskany Sandstone; Ulsterian Series. *Conularia desiderata.*

122 Anonymous. Schoharie, New York. Oriskany Sandstone; Ulsterian Series. *Conularia pyramidalis.*

123 F. M. Swartz. Clarksville, New York. "Lower Helderberg Group," probably New Scotland Limestone; Ulsterian Series. *Conularia pyramidalis.*

124 Anonymous. NYSM location 2, about 2 km south of Bridgewater, New York. Marcellus Shale; Erian Series. *Conularia desiderata.*

125 Anonymous. Bridgewater, New York. Marcellus Shale; Erian Series. *Conularia desiderata.*

126. Anonymous. Probably from near Bridgewater, New York. Probably from Marcellus Shale; Erian Series. *Conularia desiderata.*

127 Anonymous. Vicinity of Hamilton, New York. Lower part of Hamilton Group; Erian Series. *Conularia desiderata.*

128 Anonymous. Morrisville, New York. Hamilton Group, probably Solsville Member of the Marcellus Formation; Erian Series. *Conularia undulata.*

129 Anonymous. About 1.2 km northwest of Solsville, Madison County, New York. Hamilton Group; Erian Series. *Conularia undulata.*

130 P. Zell, 1982. Swamp Road quarry, near Morrisville, New York, Morrisville 7.5′ Quadrangle. Marcellus Formation; Erian Series. *Conularia pyramidalis.*

131 L. E. Babcock, J. T. Hannibal, and R. M. Feldmann, 1984. Borrow pit on east side of Swamp Road, 4.2 km north of Morrisville, New York, Morrisville 7.5′ Quadrangle. Solsville Member of the Marcellus Formation; Erian Series. *Conularia pyramidalis.*

132 Anonymous. Schoharie County, New York. Hamilton Group, possibly Schoharie Formation; Erian Series. *Conularia desiderata.*

133 M. Kopf. 4 km east of Alexander, New York. Centerfield Limestone Member, Ludlowville Formation; Erian Series. *Conularia desiderata.*

134 I. H. Reimann. Spring Creek, Alden, New York. Ledyard Shale Member of Ludlowville Formation; Erian Series. *Conularia desiderata.*

135 G. J. Kloc, 1983. Lake Erie shore, south of the Wanakah Water Plant, Wanakah, Erie County, New York, N42°44′50″ W78°54′13″. *Nautilus* Bed of the Wanakah Shale Member of the Ludlowville Formation; Erian Series. *Conularia desiderata.*

136 Anonymous. Genesee Valley, New York. Hamilton Group; Erian Series. *Conularia undulata.*

137 Anonymous. Norton's Landing, Cayuga Lake, New York. Hamilton Group, possibly King Ferry Shale Member of the Ludlowville Formation; Erian Series. *Conularia undulata.*

138 Anonymous. NYSM location 428, Shurger's Glen, near Norton's Landing, Cayuga Lake, New York. Hamilton Group; Erian Series. *Conularia undulata.*

139 Anonymous. NYSM location 437, Shurger's Glen, near Norton's Landing, Cayuga Lake, New York. Hamilton Group; Erian Series. *Conularia* sp.

140 G. C. Baird, ca. 1980; L. E. Babcock, 1983. Banks and bed of Barnum Creek, below high falls 0.4 km west (upstream) from New York Route 89 overpass, Sheldrake Quadrangle, New York. Barnum Creek Bed of the King Ferry Shale Member of the Ludlowville Formation, approximately 10 m above top of the *Pleurodictyum* zone; Erian Series. *Conularia undulata.*

141 G. C. Baird, ca. 1980. Bed of Sheldrake Creek, below high falls 0.48 km northeast (downstream) from New York 89 overpass, Sheldrake Quadrangle, Seneca County, New York. 2 m below Barnum Creek Bed, in the King Ferry Shale Member of Ludlowville Formation; Erian Series. *Conularia undulata.*

142 G. A. Cooper, ca. 1930. Hamilton, New York, Cooper location 8Qa. Upper part of Pompey Formation; Erian Series. *Conularia desiderata.*

143 Anonymous. NYSM location 558, Norwich, Chenango County, New York. Hamilton Group; Erian Series. *Conularia undulata.*

144 Anonymous. NYSM location 611, Schoharie County, New York. Hamilton Group; Erian Series. *Conularia desiderata.*

145 Anonymous. Near Cazenovia, New York. Hamilton Group; Erian Series. *Conularia undulata.*

146 Anonymous. Cazenovia, New York. Hamilton Group, possibly Moscow Formation; Erian Series. *Conularia desiderata, C. undulata.*

147 P. Zell, 1983. Thompson Hill Road quarry, near Earlville, New York, Earlville 7.5′ Quadrangle. Moscow Formation; Erian Series. *Conularia undulata.*
148 R. M. Linsley; L. E. Babcock, J. T. Hannibal, and R. M. Feldmann, 1984. "Earlville trilobite quarry," off Morris Road, near Morrisville, New York, Earlville 7.5′ Quadrangle. Upper part of Moscow Formation; Erian Series. *Conularia undulata.*
149 Anonymous. Folsomdale, New York. Rhinestreet Shale; Senecan Series. *Conularia congregata*?
150 Anonymous. Ithaca, New York. Ithaca Formation; Senecan Series. *Conularia congregata.*
151 Anonymous. NYSM location 347, Ithaca, New York. "Chemung Group"; Senecan Series. *Conularia* sp.
152 Anonymous. NYSM location 390, west side of Cayuga Lake inlet, New York. Ithaca Shale; Senecan Series. *Conularia congregata.*
153 Anonymous. NYSM location 392, 1.5 km southeast of Ithaca, New York. Ithaca Group; Senecan Series. *Conularia congregata.*
154 J. W. Hall and G. B. Simpson, 1870. NYSM location 425, Ithaca, New York. Ithaca Shale, lower part of formation; Senecan Series. *Conularia congregata.*
155 Anonymous. NYSM location 514, Catskill Turnpike, 3–4.5 km east of Stamford, Delaware County, New York. Ithaca Group; Senecan Series. *Conularia congregata.*
156 J. W. Hall and C. Van Deloo, 1866. "Mr. Cornell's Quarry," 1.5 km northeast of Ithaca; also from Cemetary quarry and Cascadilla Creek, Ithaca, New York. Ithaca Shale; Senecan Series. *Conularia congregata.*
157 D. D. Luther, 1900. NYSM locality 2439, West Hill, near Naples, New York. "Naples Group"; Senecan Series. *Conularia congregata.*
158 Anonymous. South Hill, Ithaca, New York. Ithaca Shale; Senecan Series. *Conularia congregata.*
159 P. Zell, 1982–1983. Collins Hill Road quarry, near Sherburne, New York, Sherburne 7.5′ Quadrangle. Hamilton Group; formation unknown; probably Senecan Series. *Conularia congregata.*
160 L. E. Babcock, E. L. Yochelson, and W. T. Kirchgasser, 1982. Big Sister Creek, Angola, Erie County, New York. Float in Angola Shale; Chautauquan Series. *Conularia* cf. *C. congregata.*
161 E. B. Hall. E. B. Hall locality I, Wellsville, New York. Wellsville Formation; Chautauquan Series. *Paraconularia wellsvillia.*
162 E. B. Hall. E. B. Hall locality XVIII, Almond, New York. Wellsville Formation; Chautauquan Series. *Paraconularia wellsvillia.*

NOVA SCOTIA

163 Anonymous. Cape Breton, Nova Scotia. Lower Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
164 W. Dawson. Irish Cove, Cape Breton, Nova Scotia. "Lower Carboniferous" limestone, probably Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
165 Anonymous. Windsor, Nova Scotia. Lower Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
166 D. G. Kelley, 1954. GSC location 24841, about 100 m east of corner of Route 5 and Buckwheat Road, Nyonza, Cape Breton Island, Nova Scotia. Lower Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
167 D. G. Kelley, 1954. GSC location 24844, limestone at bridge on Lewis Mountain Road, 0.8 km from Route 19, Cape Breton Island, Nova Scotia. Lower? part of Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*

168 Anonymous. Nova Scotia. Lower Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
169 Anonymous. Cape Breton, Nova Scotia. Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
170 M. J. Copeland, 1962. Shore of Bros d'Or Lake, Irish Cove, Cape Breton, Nova Scotia. Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
171 Anonymous. Brookfield, Colchester County, Nova Scotia. Lower Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
172 Anonymous. Harts County, Nova Scotia. Basal Windsor Group; Osagian-Chesterian Series. *Paraconularia planicostata.*
173 Anonymous. Maxner Point, Nova Scotia. Probably lower part of Windsor Formation; Osagian-Chesterian Series. *Paraconularia planicostata.*

OHIO

174 Anonymous. Delaware, Ohio. "Corniferous Group," probably Delaware Limestone; Ulsterian Series. *Conularia elegantula.*
175 G. Meszaros, pre-1982. Rathbone, Ohio. Columbus Limestone; Ulsterian Series. *Conularia elegantula.*
176 Hyatt Brothers. Dublin, Franklin County, Ohio. Columbus or Delaware Limestone; Ulsterian Series. *Conularia elegantula.*
177 Anonymous. Quarry 4 km southeast of Sylvania, Ohio. Silica Shale; Erian Series. *Conularia* sp.
178 G. Meszaros, pre-1982. Leroy, Ohio. Chagrin Shale; Chautauquan Series. *Conularia multicostata, Paraconularia chagrinensis.*
179 E. Roeser, 1978. Float along Mill Creek, at and near Camp Koinonia, Lake and Ashtabula counties, Ohio, north and south of Ross Road bridge. Chagrin Shale; Chautauquan Series. *Paraconularia chagrinensis.*
180 D. Strock, 1985? Along Mill Creek, from Hidden Valley Park to the church camp, Lake County, Ohio. Chagrin Shale; Chautauquan Series. *Paraconularia chagrinensis.*
181 C. Talerico, 1984; L. E. Babcock et al., 1984. Float along Mill Creek, between Ross Road bridge and small dam upstream of Ross Road, Ashtabula County, New York. Chagrin Shale; Chautauquan Series. *Paraconularia chagrinensis.*
182 T. Stanley, 1984. Mill Creek, within 165 m downstream (north) of Ross Road bridge, Lake and Ashtabula counties, Ohio. Chagrin Shale; Chautauquan Series. *Paraconularia chagrinensis.*
183 M. E. Williams, 1981; S. McKenzie, pre-1982. Float along Mill Creek, Ashtabula County, Ohio. Chagrin Shale; Chautauquan Series. *Paraconularia chagrinensis.*
184 M. E. Williams, 1981; J. Hannibal et al., 1985. Stebbins Gulch, Holden Arboretum, Geauga County, Ohio. Contact between the Chagrin Shale and the Cleveland Shale Member of the Ohio Formation; Chautauquan Series. *Paraconularia chagrinensis.*
185 A. J. Weiss, 1984. Landfill on north side of Ohio Route 82, approximately 1.2 km west of I-77 interchange, Broadview Heights, Ohio. Cuyahoga Formation, Meadville Shale Member; Kinderhookian Series. *Paraconularia byblis, P. subulata.*
186 J. Hall? Alexander, Licking County, Ohio. "Berea Shale" (=Sunbury Shale Submember, Orangeville Member, Cuyahoga Formation); Kinderhookian Series. *Paraconularia subulata.*
187 Herrick? Alexander, Licking County, Ohio. "Berea Shale" (=Sunbury Submember of the Orangeville Member of the Cuyahoga Formation?); Kinderhookian Series. *Paraconularia subulata.*
188 L. E. Babcock, 1984. Sunbury Shale Submember of the Orangeville Member of the Cuyahoga Formation; 1–3 cm thick silty zone with abundant pyrite at Sunbury-

Berea Sandstone contact; Kinderhookian Series. Quarry Rock picnic area, north of Chagrin River, South Chagrin Reservation, east of Solon Road, Bentleyville, Cuyahoga County, Ohio. *Paraconularia subulata.*

189 M. Ciccarone, 1984. Sunbury Shale Submember of the Orangeville Member of the Cuyahoga Formation; Kinderhookian Series. Quarry Rock picnic area, north of Chagrin River, South Chagrin Reservation, east of Solon Road, Bentleyville, Cuyahoga County, Ohio. *Paraconularia subulata.*

190 L. E. Babcock, 1984. Sunbury Shale Submember of the Orangeville Member of the Cuyahoga Formation; approximately 1 m above the top of the Berea Sandstone; Kinderhookian Series. Quarry Rock picnic area, north of Chagrin River, South Chagrin Reservation, east of Solon Road, Bentleyville, Cuyahoga County, Ohio. *Paraconularia subulata.*

191 G. Meszaros, pre-1982. Weymouth, Ohio. Meadville Shale Member of Cuyahoga Formation; Kinderhookian Series. *Paraconularia subulata.*

192 J. Burke, W. J. Hlavin et al., 1967. North Branch of Rocky River near bridge at junction of Bagdad and Hood Roads, Bagdad, Ohio. Meadville Shale Member of Cuyahoga Formation; Kinderhookian Series. *Paraconularia subulata.*

193 Anonymous. Probably northeast Ohio. Probably Meadville Member of the Cuyahoga Formation; Kinderhookian Series? *Conularia multicostata.*

194 Anonymous. Voorhes Cemetary outcrop, west of Lodi, Ohio. Meadville Shale Member of Cuyahoga Formation; Kinderhookian Series. *Paraconularia subulata.*

195 R. W. Scott. Lodi, Medina County, Ohio. Cuyahoga Formation, probably Meadville Member; Kinderhookian Series. *Paraconularia byblis.*

196 G. Meszaros, pre-1982. Lodi, Ohio. Meadville Shale Member of the Cuyahoga Formation; Kinderhookian Series. *Conularia multicostata, Paraconularia subulata.*

197 R. Fisher. Creeks in and near Lodi, Medina County, Ohio. Meadville Member of the Cuyahoga Formation; Kinderhookian Series. *Conularia multicostata, Paraconularia subulata.*

198 R. Segedi et al., 1974. Streambed off Pawnee Road, about 200 m south of U.S. Route 224, Lodi, Medina County, Ohio. Meadville Shale Member of Cuyahoga Formation; Kinderhookian Series. *Conularia multicostata, Paraconularia subulata.*

199 R. Segedi. About 50 m east of bridge on Pawnee Road, just south of U.S. Route 224, Lodi, Medina County, Ohio. Float and *in situ* specimens from the Meadville Member of the Cuyahoga Formation; Kinderhookian Series. *Conularia multicostata, Paraconularia subulata.*

200 L. E. Babcock, 1985. West fork of East Branch of Black River, south of Route 224, near intersection with Pawnee Road, Homer Township, about 3 km west of center of Lodi, Medina County, Ohio, Lodi 7.5′ Quadrangle. Meadville Shale Member of Cuyahoga Formation; collected *in situ* in lowermost bed of siderite concretions upstream of Pawnee Road bridge; Kinderhookian Series. *Conularia multicostata, Paraconularia subulata.*

201 A. H. Worthen. Richfield, Ohio. "Kinderhook Formation" (=Cuyahoga Formation, probably Meadville Member); Kinderhookian Series. *Paraconularia subulata.*

202 Anonymous. NYSM location 110, Richfield, Summit County, Ohio. "Waverly Group" (probably Meadville Member of the Cuyahoga Formation); Kinderhookian Series. *Paraconularia subulata.*

203 Anonymous. Richfield, Ohio. Waverly Group, probably Meadville Member of the Cuyahoga Formation; Kinderhookian Series. *Paraconularia subulata.*

204 L. E. Babcock, 1984. Float in Meadville Member of the Cuyahoga Formation; Kinderhookian Series. Tributary to the Cuyahoga River, Furnace Run Metro Park, west off Route 21, about 1.5 km south of Summit County-Cuyahoga County boundary, Summit County, Ohio. *Paraconularia* cf. *P. byblis.*

205 Anonymous. Richfield, Ohio. "Waverly Group" (=Meadville Member of the Cuy-

ahoga Formation); Kinderhookian or Osagean Series. *Conularia multicostata, Paraconularia subulata.*

206 A. Winchell. Cuyahoga River gorge, Cuyahoga Falls, Summit County, Ohio. "Near top of the Waverly Group, water limestone below conglomerate" (=Cuyahoga Formation, possibly Meadville Member); Kinderhookian-Osagean Series. *Paraconularia subulata.*

207 J. Weiss, 1961. Gravel in Akron, Ohio area? Possibly Cuyahoga Formation; Kinderhookian or Osagian Series. *Paraconularia subulata.*

208 Anonymous. "Rocky River bed," probably Cuyahoga Formation; Kinderhookian or Osagean Series. Medina, Ohio. *Paraconularia subulata.*

209 Anonymous. Bagdad, Ohio. Probably Cuyahoga Formation; Kinderhookian or Osagean Series. *Conularia multicostata.*

210 C. L. Herrick. Near Lyon Falls, Richland County, Ohio. 18–24 m above "Conglomerate II": Osagean Series. *Paraconularia byblis.*

211 W. P. Cooper, 1890; Anonymous. Portsmouth, Ohio. Waverly Group, probably the Cuyahoga Formation; Osagean Series. *Paraconularia missouriensis.*

212 Anonymous. Wooster, Wayne County, Ohio. "Near the top of the Waverly Group" (=Wooster Member of the Cuyahoga Formation); Osagean Series. *Paraconularia subulata.*

213 Anonymous. Wooster, Wayne County, Ohio. Near top of Waverly Group, possibly the Wooster Member of Cuyahoga Formation; Osagean Series. *Paraconularia subulata.*

214 G. Meszaros, pre-1982. Wooster, Ohio. Cuyahoga Formation, Wooster Shale Member; Osagean Series. *Conularia multicostata, Paraconularia subulata.*

215 H. E. Wilson. 7.2 km south of Loudonville, Ashland County, Ohio. Probably Wooster Member, Cuyahoga Formation; Osagean Series. *Paraconularia subulata.*

216 F. Plutte, 1964. About 4.5 km south of Loudonville, Ashland County, Ohio. Wooster Member of the Cuyahoga Formation; Osagean Series. *Paraconularia subulata.*

217 L. E. Babcock, 1984. East facing borrow pit on west side of Route 3, 0.9 km north of junction with Route 97, just south of Loudonville, Ashland County, Ohio, Greer 7.5′ Quadrangle. Wooster Member of the Cuyahoga Formation; Osagean Series. *Conularia multicostata, Paraconularia subulata.*

218 J. Hall? Water works in Newark, Ohio. Waverly Group, "base of Division III"; probably Cuyahoga Formation; probably Osagean Series. *Conularia multicostata.*

219 G. Meszaros, pre-1982. Rushville, Ohio. Allensville Member of Logan Formation; Osagian Series. *Paraconularia byblis.*

220 Bowsher, Savage, and Allen, 1952. Approximately 300 m of elevation below Old Maid's Kitchen, in gully about 110 m west of Ohio Edison Dam on north side of Cuyahoga Gorge, Akron, Summit County, Ohio. Float in Meadville Shale Member of the Cuyahoga Formation; Kinderhookian Series. *Paraconularia subulata.*

221 Anonymous. Ohio. Possibly Cuyahoga Formation; Mississippian, possibly Osagean. *Conularia multicostata, Paraconularia subulata.*

222 Anonymous. Ohio. "Lower Waverly Group," Cuyahoga Formation; Osagean Series. *Paraconularia subulata.*

223 Stout and Girty, 1897. Dixon's Mill, on the Little Scioto River, about 5 km northeast of Sciotoville, Scioto County, Ohio. "Waverly Group," probably Wooster Member of Cuyahoga Formation; Osagian Series. *Conularia multicostata, Paraconularia byblis, P. missouriensis.*

224 Carman, Stout, and Carney. Sciotoville, Ohio. Upper part of Cuyahoga Formation, 16.5–23 m below base of the Logan Formation; Osagian Series. *Paraconularia byblis*?, *P. missouriensis.*

225 F. B. Meek; Anonymous. Sciotoville, Ohio. "Waverly Group," probably Cuyahoga Formation; Osagean Series. *Conularia multicostata.*

226 E. B. Andrews, 1869. Sciotoville, Ohio. Uppermost Cuyahoga Formation, Black

Hand Member or lowermost Logan Formation, Byer Member; Osagean Series. *Paraconularia missouriensis.*

227 G. Meszaros, pre-1982. Sciotoville, Ohio. Portsmouth Shale; Osagean Series. *Conularia multicostata, Paraconularia missouriensis.*

228 Cooper. James Hall's location 385, Moot's Run, Licking County, Ohio. Cuyahoga Formation, probably Wooster Member; Osagean Series. *Conularia multicostata.*

OKLAHOMA

229 G. A. Cooper et al., 1952. NE¼ Sec. 7 T22N R20E, 5.3 km south of Adair, Mayes County, Oklahoma. Fayetteville Formation; Chesterian Series. *Paraconularia oklahomaensis.*

ONTARIO

230 C. S. 9.6 km west of Cayuga, Ontario. Upper part of Oriskany Sandstone; Ulsterian Series. *Conularia undulata.*

PENNSYLVANIA

231 F. M. Swartz. Near Curtin, Pennsylvania. Shriver Chert; Ulsterian Series. *Conularia ulsterensis.*

232 F. M. Swartz. Intersection of Delaware and New York State Railroad, 0.8 km west of mill of Mimsruk Paper Company Experimental Mills, near Curtin, Pennsylvania. Shriver Chert; 1.05 m below Oriskany Shale; Ulsterian Series. *Conularia* cf. *C. desiderata.*

233 F. M. Swartz, 1937. Float on roadcut on road leading through gap east of Warfordsburg, Pennsylvania. Shriver Formation?; 0.3–1.7 m above conglomeratic sandstone at middle of Shriver-like beds; Ulsterian Series. *Conularia ulsterensis.*

234 F. M. Swartz, 1937. Roadcut along road leading through gap east of Waifordsburg, Pennsylvania. 0.3–1.5 m above conglomeratic sandstone at middle of Shriver-like beds; Ulsterian Series. *Conularia ulsterensis.*

235 F. M. Swartz. Road leading north from Schellsburg, Bedford County, Pennsylvania. Onondaga Shale; Erian Series. *Conularia* cf. *C. desiderata.*

236 S. Albright, 1981; B. White, 1983. Large roadcut on north side of Johnny Bee Road, about 0.2 km north of intersection with road to Dingmans Falls, Delaware Township, Pike County, Pennsylvania. Mahantango Formation, approximately Centerfield biostrome level; Erian Series. *Conularia desiderata, C. ulsterensis, C. undulata.*

237 D. Parris, 1982. Large roadcut on north side of Johnny Bee Road, about 0.2 km north of intersection with road to Dingmans Falls, Delaware Township, Pike County, Pennsylvania. Manhantango Formation; Erian Series. *Conularia undulata.*

238 L. Klensch and J. Valenti, 1981. Roadcut across from Bushkill Country Store, 2 km from U.S. Route 209, Lehman Township, Pike County, Pennsylvania. Mahantango Formation; Erian Series. *Conularia undulata.*

239 L. Decina, 1983. Roadcut on north side of Pennsylvania Route 895, approximately 0.8 km west of Auburn, Schuylkill County, Pennsylvania. Mahantango Formation; Erian Series. *Conularia desiderata.*

240 Anonymous. Huntingdon, Huntingdon County, Pennsylvania. Frame Shale Member of the Mahantango Formation; Erian Series. No conulariids collected; *Hyolithes* sp.

QUEBEC

241 R. B., 1862; Anonymous. Grande Grève, Gaspé, Quebec. Grand Grève Limestone; Ulsterian Series. *Conularia* cf. *C. desiderata, C.* cf. *C. undulata.*

242 Anonymous. High Falls, Dartmouth River, Gaspé Peninsula. Grande Grève Limestone; Ulsterian Series. *Reticulaconularia penouili.*
243 Anonymous. Little Gaspé, Quebec. Grande Grève Limestone; Ulsterian Series. *Conularia* cf. *C. desiderata.*
244 Anonymous. Percé Rock, Gaspé, Quebec. Grande Grève Limestone; Ulsterian Series. *Conularia tuzoi.*
245. Cape Barre, Quebec. "Cape Barre beds" (=Cape Bon Ami Formation); Ulsterian Series. *Conularia* cf. *C. desiderata.*
246 Anonymous. Gaspé Peninsula, Quebec. Float block of limestone, probably Grande Grève Limestone; Ulsterian Series. *Reticulaconularia penouili.*
247 J. W. Beede? Magdelen Islands, Quebec. Formation and series unknown; Mississippian Subsystem. *Paraconularia sorrocula.*
248 J. W. Beede? Cape le Tron, Grindstone Island, Magdelen Islands, Quebec. Formation and series unknown; Mississippian Subsystem. *Paraconularia planicostata.*

South Dakota

249 L. E. Babcock, 1984. "Slagpile section," overlooking bridge of Route 14A over Whitewood Creek, SW ¼ Sec. 13, T5N R3E, Deadwood, Lawrence County, South Dakota, Deadwood 7.5′ Quadrangle. Englewood Formation, dolostone about 20 cm above top of shale-dolostone transitional zone. *Paraconularia* sp.

Tennessee

250 J. M. Safford. Hickman County, Tennessee. "Waverly Group"; Kinderhookian or Osagean Series. *Paraconularia byblis*?
251 A. S. Horowitz, 1966, etc. Roadcuts on both sides of Interstate Highway 40, 8.3 km west of junction of Interstate Highway 40 and U.S. Highway 70 at Monterey, Putnam County, Tennessee, Monterey 7.5′ Quadrangle. Top of Pennington Formation; "Kinkaid level," zone of *Pterocrinus tridecibrachiatus* Gutschick, just below a quartz pebble conglomerate of the Pennsylvanian System; Chesterian Series. *Paraconularia chesterensis.*

Utah

252 C. D. Walcott? Divide Bet, American Fork and Snake Creek, Wasatch Mountains, Utah, Kinderhookian or Osagean Series. *Paraconularia chesterensis*?

Wisconsin

253 E. E. Teller. Milwaukee, Wisconsin. Probably Milwaukee Formation; Erian Series. *Conularia milwaukeensis.*
254 E. E. Teller? Estabrook Park, Milwaukee, Wisconsin. Lindwurm Member of the Milwaukee Formation; Erian Series. *Conularia milwaukeensis.*
255 E. E. Teller. Milwaukee Cement Quarry, Berthelet, Wisconsin. Milwaukee Formation; Erian Series. *Conularia milwaukeenensis.*

Appendix B—Measurements

The following values are measurements of selected type and other conulariid specimens considered representative of each taxon treated herein and in Part A. Species are listed alphabetically according to species as they are recognized herein. Measurements are listed in columns across each page. In cases where replicate measurements have been taken at varying distances from the hypothetical apex, they are listed vertically under the appropriate columns. Terms are defined in the "Morphology" section. Abbreviations: L, length,

cm; HL, hypothetical length, cm; AAMj, major apical angle, degrees; AAMn, minor apical angle, degrees; N, nodes/mm; RLAMj, ratio of right superior : left superior : abutting rods per ten on major face; RLAMn, ratio of right superior : left superior : abutting rods per ten on minor face; D, distance from hypothetical apex at apicad limit of measurement, applicable to values for R and RA; R, rods/cm; RA, rod angle, degrees; h, holotype; plh, plastoholotype; 1, lectotype; n, neotype; p, paratype; pl, paralectotype. Values given in parentheses are approximate; values followed by question marks are accurate, but it is not certain that they have been properly classified as pertaining to either the major or minor face.

Conularia congregata Hall

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
NYSM 3483 1	6.1	9.4	17	12	6	0:0:10	0:0:10	5.5	18	10
								8.0	16	13
NYSM 3483 pl	6.7	10.7	17	14	7	0:0:10	0:0:10	5.5	17	10
								8.5	21	9
NYSM 3483 pl	6.5	10.1	16	14	6	0:0:10	0:0:10	5.0	17	10
								8.5	20	12
NYSM 3483 pl	6.3	9.9	17	13	6	0:0:10	0:0:10	8.0	16	10

Conularia delphiensis (Maroney and Orr)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
IUPC 14470-1 h	2.0	(4.8)	—	—	6	1:1:8	1:1:8	6.0	36	10
IUPC 14470-2 p	2.1	(5.1)	—	—	—	1:0:9	0:1:9	4.5	36	11
IUPC 14470-4 p	2.7	(3.4)	15?	—	—	0:0:10	0:0:10	1.6	42	—
IUPC 14470-6 p	—	—	—	—	7	—	—	—	—	—

Conularia desiderata Hall

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
AMNH 2697 h	1.6	2.3	23	20?	—	0:10:0	0:10:0	3.5	27	15
NYSM 3487	5.8	6.4	27	22	3	1:8:2	1:9:0	5.0	17	12
								7.0	14	7
NYSM 3485	6.2	8.2	16	15	3	2:7:1	3:6:1	3.5	24	9
								6.5	20	10
USNM 395827	0.9	0.9	22	21	—	0:0:10	0:0:10	0.6	41	16

Conularia elegantula Meek

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
AMNH CU 282G h	3.9	6.7	20	17?	6	0:4:6	—	1.0	39	8
								4.0	37	13
CMNH 4584	2.7	3.2	(30?)	—	6	0:6:4?	—	3.5	32	3
CMNH 4648	3.1	(4.5)	—	—	5	—	—	(4.0)	(24)	—

Conularia milwaukeensis Cleland

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
USNM 85988 h	3.1	5.0	15	14	6	0:0:10	0:0:10	6.0	18	5
MPM 20252	4.9	6.0	12	11	6	0:0:10	0:0:10	4.0	21	16
MPM 22974	4.5	4.6	15	13	5	0:0:10	0:0:10	4.0	24	18
								6.0	18	8
								8.0	20	9

Conularia multicostata Meek and Worthen

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
USNM 50157 p1h	2.8	6.7	20	18	—	0:0:10	0:0:10	4.5	32	16
UK 6089	6.3	8.5	—	11?	3	—	0:0:10?	9.5	52	12
AMNH 6713	6.5	9.3	23	22	2	0:0:10	0:0:10	5.0	40	17
								8.0	44	9
CM 34533	8.2	11.2	16	15	2	0:0:10	0:0:10	4.0	25	—
								5.5	29	12

Conularia pyramidalis Hall

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
AMNH 33017 1	2.3	3.3	18	17	3	0:0:10	0:0:10	3.0	14	11
								5.5	11	16
								7.5	9	9
NYSM 3490	11.8	19.2	23	17	1	0:0:10	0:0:10	8.0	7	22
								12.0	10	9
								15.0	10	5

Conularia subcarbonaria Meek and Worthen

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
UIPC 10680 h	8.6	11.9	21	19	4	0:0:10	0:0:10	8.0	18	4
FMNH UC 18494	24.5	33.5	10	9	4	0:0:10	0:0:10	18.0	27	5
								25.0	31	6
FMNH UC 6289	7.7	—	—	—	3	0:0:10	0:0:10	—	—	—
FMNH UC 6610	3.1	—	—	—	2	—	—	—	60	—

Conularia tuzoi Clarke

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
NYSM 9404 h	6.7	11.3	(10)	—	—	(0:0:10)	—	6.0	26	9
								9.0	36	10

Conularia ulsterensis Howell

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
PU 42071 h	1.8	2.5	18?	—	7	2:0:8?	—	4.5	45	13
CM 34528	1.9	3.2	17?	—	7	0:0:10?	—	2.2	60	12
								2.8	84	11
CM 34529	1.8	(2.8)	(18)	(15)	6	0:0:10	0:0:10	(2.0)	62	12

Conularia undulata Conrad

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
AMNH 41093 1	10.0	15.5	13	10	6	1:0:9	1:0:9	6.0	21	18
								10.0	20	11
								13.0	27	4
AMNH 5440	8.3	—		(8)	4	—	—	—	30	—
NYSM 3482	10.2	11.8	18	15	5	0:0:10	0:0:10	4.5	17	9
								9.5	24	10
CM 34532	7.5	(18.0)	21	14	5	0:0:10	0:0:10	18.0	32	9

Paraconularia alpenensis Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
GSC 85060 h	1.5	3.6	21	16	—	2:2:6	4:2:4	3.0	14	9
								4.0	14	10

Paraconularia alternistriata (Shimer)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
GSC 5111 h	0.8	1.9	11	10	0	10:0:0	3:7:0	1.0	28	11

Paraconularia blairi (Miller and Gurley)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
UCGM 3986 1	7.4	11.2	(22)	20	3	6:4:0	3:5:2	5.5	11	8
								8.5	7	9
								11.0	9	15
UMC 4270	3.4	(11.5)	23?	—	3	7:2:1?	—	(16.0)	6	19
UCGM 3985	6.8	(16.0)	—	16	2	—	7:3:1	12.5	6	—
UCGM 3984 p1	9.2	15.5	—	18	3	—	5:4:1	8.0	8	15
								11.0	6	14
								14.0	6	15
AMNH 25056	13.0	19.0	11	10	2	8:1:1	2:6:2	7.0	13	9
								12.5	8	12
								16.0	7	17

Paraconularia byblis (White)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
UMMP 2167 h	6.7	10.0	22	(14)	1	1:4:6	—	6.5	15	12
CMNH 4691	2.8	3.8	26	—	1	1:7:2	—	2.5	28	13
USNM 409489	1.7	2.1	19	14	1	1:6:3	6:2:2	1.0	29	18

Paraconularia chagrinensis Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
CMNH 6633 h	3.9	4.9	28	21	4	0:9:1	0:9:1	2.0	20	12
								3.0	18	9
								4.2	16	10
CMNH 1622 p	3.4	8.3	—	20?	—	0:7:3	0:8:2	5.0	16	9
CMNH 1818 p	2.0	—	—	—	4	—	—	—	—	—
CMNH 1674 p	4.5	(10.0)	—	—	3	—	—	—	—	—

Paraconularia chesterensis (Worthen)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
ISGS 2489 h	11.7	17.2	14	10	4	4:5:1	4:2:4	7.5	11	10
								10.0	10	9
								14.0	8	11
USNM 50156	2.7	3.9	21	17	5	4:3:3	8:2:2	1.0	25	8
								2.0	20	8
IUPC 17413	9.7	16.6	(14)	—	5	(4:5:1)	—	15.5	7	15
IUPC 11313	12.8	25.5	9	9	4	4:5:1	4:5:1	14.0	6	9
								20.0	5	9
								23.0	6	13
IUPC 6458	9.8	35.5	8	(7)	4	5:2:3	2:6:3	26.0	5	9
								30.0	4	11

Paraconularia missouriensis (Swallow)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
FMNH UC 6639 p1h	11.0	14.6	19	—	—	1:9:0	—	6.5	6	9
								9.5	4	6

FMNH UC 6628	11.2	15.5	15	11	2	1:9:0	1:8:1	6.0	6	6
								13.0	5	10
FMNH UC 6627	12.8	19.5	14	11	3	2:8:0	3:7:0	10.0	6	11
								14.5	5	17
								19.0	5	11
AMNH 28692	5.7	13.8	—	10	—	—	9:1:0	10.0	6	8
UMMP 26740	3.6	6.4	21	15	2	3:5:2	4:4:2	4.0	10	9

Paraconularia oklahomaensis Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
USNM 409801 h	4.4	5.4	19	17	0	4:1:5	2:4:4	2.0	24	12
								4.0	12	13

Paraconularia planicostata (Dawson)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
RM(MU) 2749 h	4.5	7.3	11?	9	0	6:3:1	5:4:1	3.5	19	12
								6.0	13	15
GSC 7715	3.3	4.9	18	14	0	5:4:2	5:3:2	3.0	14	15
GSC 24644	1.6	5.3	13	12	0	3:6:1	5:3:2	3.5	20	12

Paraconularia recurvatus Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
USNM 409806 h	4.8	7.8	16	15	3	2:5:3	2:4:4	4.0	18	12
								6.0	(26)	8
USNM 409807 p	0.8	—	—	—	2	—	—	—	28	—
USNM 409808 p	1.1	2.6	16	—	3	3:6:1	3:5:2	1.5	26	8
USNM 409809 p	0.7	—	—	—	3	—	—	—	24	—

Paraconularia salinensis (Whiteaves)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
GSC 4292 h	2.6	3.0	(24)	21	4	7:2:1	5:3:2	1.0	24	13
								1.5	23	8

Paraconularia sorrocula (Beede)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
NYSM 9414 h	2.3	2.9	23	—	6	1:7:2	—	0.8	20	11
								1.2	19	14

Paraconularia subulata (Hall)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
AMNH 32404 1	0.6	0.8	21	18	4	5: 2:3	6:1:3	0.5	56	11
FMNH UC 6961	1.6	2.4	18	12	5	0:10:0	3:7:0	1.0	35	18
								1.5	35	11
UIPC 10866	6.6	7.8	—	12	4	—	7:1:2	5.0	8	22
UMMP 2178	0.9	(5.5)	—	—	4	—	—	—	24	(19)
UMMP 245	0.5	1.4	22	(20)	4	0:7:3	6:3:1	1.0	30	11
OC 8309	5.4	12.8	12	10	2	1:8:1	4:5:1	11.0	8	15

Paraconularia wellsvillia Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
CM 35001 h	5.7	12.5	(14)	(13)	3	1:8:1	5:4:1	8.5	4	26
								10.0	5	31

CM 34502 p	5.8	(12.5)	(18)?	—	3	3:6:1?	—	7.5	9	(24)
								12.0	7	(18)

Paraconularia yochelsoni Babcock and Feldmann, new species

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
UMMP 45499 h	2.2	2.6	20	18	0	5:3:2	10:0:0	0.6	15	18
								1.5	14	17
UUMP 45500 p	2.6	3.1	17	—	0	6:1:2	—	0.6	18	15
								1.5	13	15
UMMP 65509 o	1.3	1.7	15	—	0	8:1:1	—	0.6	18	20

Reticulaconularia penouili (Clarke)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
NYSM 9412 h	4.6	6.7	59	(22)	2	2:5:3	3:5:2	3.0	14	4
								4.5	21	3
								6.0	14	0
GSC 87242	5.5	6.4	—	30?	2	—	5:4:1?	1.3	15	7
								3.3	12	8

Reticulaconularia sussexensis (Herpers)

SPECIMEN NO.	L	HL	AAMj	AAMn	N	RLAMj	RLAMn	D	R	RA
NJSM 10749 h	2.7	3.1	32	26	1	0:2:8	—	2.5	20	11
								3.5	36	8
NJSM 10750 p	1.5	1.8	(27)	24	2	1:2:7	2:1:7	0.6	39	14
								1.5	16	11